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NICARAGUA CANAL.

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REPORTS

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OF THE

COMMITTEE ON FOREIGN RELATIONS

OF

THE SENATE

IN THE

FIFTY-FIRST, FIFTY-SECOND, AND FIFTY-THIRD CONGRESSES,

WITH

SUBJECT INDEX.

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53D CONGRESS, 2d Session. } SENATE. { REPORT No. 331.

Sav. 3183

IN THE SENATE OF THE UNITED STATES.

APRIL 14, 1894.—Ordered to be printed.

MR. MORGAN, from the Committee on Foreign Relations, submitted the following

REPORT:

[To accompany bill S. 1481.]

The action of the Committee of the Senate on Foreign Relations upon bills heretofore reported for aiding in the construction of an interoceanic canal through Nicaragua is set forth in reports No. 1944, Fifty-first Congress, second session, and No. 1142, second session of the Fifty-second Congress, made by Mr. Sherman as chairman of the committee.

Those reports are adopted in this report and are made a part thereof.

Since December 22, 1892, the date of the last report of the committee, the president of the canal company has made an annual report to the Secretary of the Interior, as required by law, which, with his report made December 3, 1892, is appended to this report. These reports are made under oath by the president, and they set forth the actual condition of the work on the canal and of the canal property up to December, 1893. Before the date of the last of said reports work on the canal was suspended in consequence of the disturbed state of the money market, and has not been resumed.

In consequence of such suspension there has been some loss, but not of a serious character, in the depreciation of the plant connected with the construction of the canal, but all the dredges and machinery requisite for dredging, and the houses, structures, and wharves necessary for the work on the eastern division, have been supplied, and, with slight repairs, are in condition for the immediate resumption of the work on the canal.

These facilities for the work have been carefully prepared, and at a very low cost. The work on the canal and railroad alongside and the deepening of the channel leading into the harbor at Greytown has been done at a cost that is within the estimates of the engineers.

Some expected difficulties have been solved in respect of clearing the canal line, and as to the nature of the soil in the low grounds between the seashore and the divide formed by a ridge of low hills to the west of the mouth of the canal. These apprehended difficulties have been developed and overcome and leave the entire line of the canal, from ocean to ocean, free from all practical embarrassment arising from any uncertainty as to the nature of the soil through which it is to be constructed.

ENGINEERING AND COST.

The engineering work on the canal, upon which depends its success as a waterway, has been done so thoroughly as to escape even a suggestion that it is faulty, or that it needs correction, after a critical examination by many of the best engineers in the United States and in Europe.

The details of the engineering and the estimates of cost of the canal are given in the previous reports of the committee and need not be here repeated as no occasion has arisen for any alteration in them.

The grand total of the estimates of the actual cost of the canal, completed for full service and extending to deep water in the Caribbean Sea and Pacific Ocean, through completed harbors, is stated in the report of Chief Engineer A. G. Menocal "revised to conform to information obtained up to January 1, 1890," at $52,067,340.55. To this sum Mr. Menocal added "surveys, hospitals, shops, management, and contingencies, 25 per cent," amounting to $13,016,835.45, making the grand total of $65,084,176.

At the request of the chief engineer, the Maritime Canal Company submitted the full data of his estimates to a board of five engineers, who were selected without any suggestion from Mr. Menocal, for critical examination and revision.

This board was composed of the following named engineers: John Bogart, E. T. D. Myers, A. M. Wellington, H. A. Hitchcock, and Charles T. Harvey, all of them men of distinguished ability and established reputation.

They united in a report dated May 9, 1892, in which they increased the estimates of Mr. Menocal to the sum of $73,166,308 for actual cost of the canal and $14,633,262 "to cover specified and unspecified contingencies, labor agencies, shops, police, sanitary service, and incidentals." The grand total of their estimate was $87,799,570.

The reasons for the increase of the estimates are stated fully in their report.

They were cautionary in their character and largely conjectural, as is shown by the following extract from their report:

> We have carefully examined the unusually full maps, profiles, borings, samples of materials, etc., which have been prepared and collected under the directions of your chief engineer, and the completeness and excellent form of which reflect credit upon your engineering staff.
>
> We find certain elements of the designs submitted which may probably be advantageously modified. This would in some cases reduce and in others increase the quantities. It is also altogether likely that some parts of the work may be let at lower and other parts at higher prices than are estimated. We, however, are disposed to base our conclusions on quantities and prices which should prove sufficient to accomplish it upon the assumption of good and honest management, backed by an ample treasury. We have necessarily borne in mind the fact that the cost of the notable precursors of this canal project, both at Suez and Panama, has greatly exceeded the amount of the original estimates, and that this has been true of many other important works. While this might be, perhaps, in a large measure traced to unfortunate management, as well as the lack of such careful preliminary studies as have been laid before us in this case, we have nevertheless endeavored to guard against a similar result by a liberal allowance for every apparent contingency.
>
> Acting on this principle, we have not yet deemed it wise to reduce the quantities or prices of your chief engineer's estimates in any instance, even when it appeared possible that this might prudently be done. His figures are, of course, founded upon a better knowedge of the local conditions than we can now possess. But to the extent to which it has appeared at all doubtful we have liberally increased one or both.

The Maritime Canal Company and the Canal Construction Company, composed of men of great business capacity and experience, proceeded to raise the money to inaugurate this work and to prosecute it until it would command the confidence of capitalists and the stock exchange, upon the basis of this increased estimate, and they have expended, wisely and with careful economy, more than $4,000,000 upon it. The *work, so far, has* fallen within the estimates of Mr. Menocal, The Government of Nicaragua caused a careful examination of the work to be made, in order to ascertain and determine whether it had been prosecuted in compliance with the conditions of the concession. The President of Nicaragua, in a message to the Congress of that Republic, made the following statement as to the operations of the Maritime Canal Company up to December 25, 1890:

> The questions with the Interoceanic Canal Company, which were pending at the death of President Carazo, have been satisfactorily settled by an agreement made the 8th of October last year, and from that date the works of construction have been prosecuted, if not with the rapidity which we are bound to desire, with patriotic impatience, yet with the firmness, formality, and good judgment required to raise the credit of the enterprise in the money markets and attract the capital wanted for its realization.
>
> The company has fully complied with the condition imposed upon it by article 47 of the Cardenas-Menocal contract—that is, to spend $2,000,000 within the first year after beginning the work of construction; and all the preliminary works already finished and the works which are being carried on give us right to believe that the opening of your Isthmus will become within a relatively short time a beautiful reality. Only yesterday and a vessel of great draft entered the harbor excavated by the canal company, in the same place where for so many years nothing could be seen but lagoons and banks of shifting sand.

The report of the commissioners appointed to inspect the work on the canal was made to that Government on November 6, 1890, and stated that after investigation they found that the Maritime Canal Company had expended between October 5, 1889, and October 7, 1890, the sum of $3,099,971.02 upon the canal.

This report was received and published in the Official Gazette of November 22, 1890, and thereupon it was officially stated by President Sacaza that all the requirements of article 47 of the concession had been fully complied with by the Maritime Canal Company of Nicaragua.

THE ACTION OF CONGRESS.

While this work was being thus successfully prosecuted by private citizens, with their own money, and after a contract had been made with a construction company for the entire work to be done on the canal, the Senate, on April 11, 1890, adopted the following resolution, in an executive session:

> *Resolved*, That the Committee on Foreign Relations be, and it hereby is, directed to inquire into what steps have been taken under the act of Congress entitled "An act to incorporate the Maritime Canal Company of Nicaragua," approved 20th February, 1889, and what are the present conditions and prospects of the enterprise; and to consider and report what, in its opinion, the interests of the United States may require in respect of that interoceanic communication.

In obedience to that resolution, the committee proceeded to make inquiry and summoned before it all the persons who had accurate knowledge of the subject committed to them. The statements of the persons examined and the papers laid before the committee are printed in the report of the committee made, unanimously, on the 10th January, 1891.

A free and full discussion was had between the committee and the officers of the Maritime Canal Company and the construction company, which resulted in the bill first reported by the committee to the Senate. That bill embodied the terms upon which it was ascertained that all persons concerned in said canal as owners or contractors were willing and consenting to place the concessions of Nicaragua and Costa Rica, and all that had been done under them within reach of the power of Congress in granting aid to the canal, so that the Government of the United

States would be fully secured against loss upon its guarantee of the bonds of the company to the amount of $100,000,000.

The reduction of the stock of the company to $100,000,000, the limitation of the issue of bonds to a like sum, the retirement and cancellation of all the existing contracts and obligations of the company, and the appointment of Government directors in the company, were the leading conditions imposed upon the Maritime Canal Company in the bill that was reported to the Senate. It is not necessary here to point out more fully the provisions of that bill.

This action of the Senate and its acceptance by the people created the belief and excited the desire of the country that the canal would be speedily constructed under the immediate auspices of the Government of the United States, and with the use of its credit.

This sentiment and conviction has increased from that time to the present, and it has been encouraged by the fact that the great leading political parties of the country have declared in favor of its construction by the United States, as far as that may be done under the concessions of Nicaragua and Costa Rica. In the annual messages of our Presidents this subject has uniformly received a strong indorsement. The policy of the measure then reported, and of the bill herewith reported, is largely based upon the duty of Congress to make the rates of tolls on the canal as cheap as is consistent with duty to the stockholders for the benefit of our coastwise commerce.

Under such circumstances it was natural that the owners of these concessions should confidently expect that they would be virtually required to yield their property and their rights as concessionaires to the disposal of Congress.

The action of the Senate was taken up, eagerly, by the people in all parts of the country, who, in State and commercial conventions, in boards of trade, and in earnest individual effort, discussed the subject and sent many memorials to Congress asking that the United States Government would proceed with the work, so that this should be "an American canal under American control." When the people had thus taken up the subject and were pressing its consideration it seemed to be impossible, as it would be unpatriotic, that the canal should be placed under the control of a European Government, or should be constructed by and placed in the power of European capitalists.

Under such conditions the property of the company and its credit were virtually placed in the power of Congress, and the company was so far deprived of its freedom of action that no effort was made to secure foreign aid, either from capitalists or governments.

Then the disturbance in the financial affairs of the world, which began in the Argentine Republic, extended to Australia and then to Europe, and finally to the United States, cut off all hope, apparently, of the construction of the canal for years to come by the unaided efforts of the company, and forced the suspension of work upon it.

When the canal company was thus rendered powerless, as it appeared, to go on with the work, capitalists from Europe made propositions to the company, which are yet pending, to enter into an agreement for the completion of the canal on terms far more liberal to its present owners than any that have been offered by the United States.

If action by Congress is delayed unreasonably the company will be compelled either to abandon the concessions and lose the money they have already invested in the canal or to accept the offers made to them by the foreign capitalists.

If either of these results should follow the inaction of Congress, the people could not censure the canal company for yielding to a fate that they could have avoided if Congress had not taken up the subject of constructing the canal through the aid of the United States.

The work done on the canal is permanent, as far as it has progressed, is important as a demonstration of the final success of the location and plan of the canal, and it will not be abandoned by the commercial world. The canal will be built.

THE CONCESSIONS.

The value of the concessions made by Nicaragua and Costa Rica to the "company of construction," which have been made permanent and irrevocable by the decrees of those Governments, could scarcely be overstated; and the Government of the United States, in its legislation, granting a charter to the company which is accepted by those governments, and is being acted upon and conformed to by them, is closely connected with all that is granted in those concessions.

The concessions are very liberal in grants to the canal company of every right and privilege that can be necessary for the construction, control, protection, neutrality, maintenance, and management of the canal. They are framed with extreme care in every particular, so as to define clearly the rights and privileges embraced in the grants and reservations. The concessions cover the period of two centuries. They cover a fee-simple grant of more than a million acres of land of very valuable quality, in a country that is elevated considerably above the water level, with an equable and healthy climate, with cheap and convenient transportation, after the canal is completed, covered with valuable forests; especially adapted to the culture of coffee, cocoa, sugar, sisal, and other valuable textiles, and all the tropical fruits.

Mr. Menocal, the chief engineer of the maritime canal of Nicaragua, in a recent letter addressed to the chairman of this committee, thus describes the lands granted to that company in the concessions of Nicaragua and Costa Rica:

U. S. NAVY-YARD, *Norfolk, April 9, 1894.*

Hon. JOHN T. MORGAN,
U. S. Senator:

DEAR SIR: Referring to your inquiries in connection with the lands granted by Nicaragua and Costa Rica in their respective concessions to the Maritime Canal Company of Nicaragua, I beg to say that, as a large proportion of this land is comprised in alternate irregularly shaped lots on both banks of the river San Juan, from the lake to Ochoa, and on the flowage line of the basins in the valleys of the San Francisco and Deseado, their aggregate acreage can only be accurately determined after a careful location of all the lots fronting on the sinuous banks of the river and basins. However, it may be safely estimated that the fee simple grants by Nicaragua aggregate not less than 800,000 acres and those by Costa Rica 200,000 acres.

Both Nicaragua and Costa Rica have placed at the disposal of the company, free of charge and without reservation, all the spaces belonging to the States, whether on the mainland or in the lake and its islands, or at the ports, roadsteads, or rivers, necessary for the construction of the canal and its accessory works, and for the deviations of streams as well as for reservoir, the areas flooded by waters raised by the construction of dams, and the spaces occupied by the ports, railroads, light-houses, buildings, etc. The acreage of the lands included in these easements may be estimated at not less than 150,000 acres, and 50,000 in Nicaragua and Costa Rica, respectively.

All the lands occupied by the canal from the Atlantic to the lake belong to the states of Nicaragua and Costa Rica. West of the lake the canal is located through private lands, and the canal company has already paid to the Government of Nicaragua $50,000 for 2,000 acres of land required for the construction of the canal on that side, as provided in Article XX of the concession.

Of the 1,000,000 acres of lands included in the fee-simple grants of Nicaragua and Costa Rica 360,000 acres are located in alternate lots on both sides of the canal and along the banks of the river San Juan from the Atlantic to the lake, and 640,000 acres are comprised in 40 lots of 20 square miles each granted by Nicaragua, and 25 lots of 8 square miles each ceded by Costa Rica. These lots are to be selected by the company in accordance with these governments from the existing public lands.

As to the value of these lands, it is difficult to arrive at a fair estimate at present. Between the lake and the Atlantic the country is covered with a virgin forest, containing an unlimited supply of timber, well adapted for constructions of all kinds, and of great value in connection with the building of the canal and for exportation when adequate means of transportation to the ports have been established. At present the unimproved navigation on the river San Juan is the only route connecting the Atlantic with the interior of the country. There are several large streams, tributaries of the San Juan, which, by the building of the canal, would be made navigable several miles into sections of the country now inaccessible by land or water, but these streams, like the mother river, are now in the same condition the Spanish conquerors found them.

The soil is uniformly fertile and offers many advantages for the cultivation of sugar, rice, beans, corn, fiber plants, cocoanuts, bananas, oranges, pineapples, and other tropical and semitropical plants, and in the highlands specially adapted for the cultivation of coffee. This statement is sustained by the dense growth and high forests covering that section of the country and by the small settlements found on the banks of rivers, where the native huts are surrounded by exuberant orchards and vegetable gardens, from which the settler gathers two or more crops annually by only dropping the seeds and letting nature take its course.

On the coast the land is low, but well drained by numerous small streams and small lakes, and is specially adapted for the cultivation of bananas and other tropical fruits. A few miles to the interior the foothills are met with, and from there to the lake the country is rolling, with intervening fertile valleys, the hills rising 50 to 300 feet; the whole being well watered and covered with a luxurious growth and giant trees.

Under the modifying influence of the northeast trades constantly cooling and purifying the air, the temperature varies from about 74° at night to 85° in the shade at noon, rarely reaching 90°; and as to the healthfulness of the country I can add to the official records of the Government surveying expeditions and of the anal company my own personal experience in the last twenty years. During that time I have made eleven trips to Nicaragua, with an average residence in the country of about six months on each trip, or five and one-half years altogether. While there, myself and assistants were constantly engaged in the arduous work of exploring this uninhabited section, cutting our way through the dense undergrowth, wading rivers and swamps, and running instrumental lines in all directions where the topography suggested any favorable features for the location of the canal.

We lived on the plainest food and slept at night under the scanty protection of a piece of canvas, a rubber blanket, or a few palm leaves. These hardships and privations were of several months duration, and on some of my trips without medical advice. Fortunately none was ever needed. No member of the party ever suffered serious inconvenience from illness due to the climate, and our health, far from being impaired, was generally improved, and we all returned to our homes in better condition than when we left it. The country, therefore, offers advantages for agricultural pursuits as well as for residence, and it is reasonable to expect that, with the building of the canal and the introduction of railroads, improved water transportation, and the increase of population, the land grants referred to will become very valuable.

Hoping that this information may be of some value to you in connection with the subject we both have so much at heart, I remain, with best wishes and kindest regards, yours sincerely.

A. G. MENOCAL.

All minerals in these lands are granted to the company, and they are regarded by careful observers as being valuable.

When the canal is completed these lands will be worth not less than $10,000,000, and if they are sold during the progress of the construction will yield a large sum to the treasury of the company.

Among the valuable grants made to the canal company are the bed of the river San Juan from the location of the great dam into and through Lake Nicaragua, for all the uses and purposes of constructing the canal and of unrestricted navigation.

COMMERCIAL AND POLITICAL VIEW.

A more general view of the value of the grants in these concessions to the commerce of the United States, to our coast-line traffic, and with reference to their importance in a military sense, necessarily raises the estimate of their value into a sum which, if counted in money, is really incalculable. The former reports of this committee, which are embodied in this report, contain exact data throwing the full light of truth upon this subject, and render a more extended comment unnecessary.

Several valuable papers that treat of these subjects have been recently printed by order of Congress, included in which are the reports of Capt. Scriven and Maj. Dutton of the U. S. Army, and others, besides reports upon Hawaii and our rights in Bering Sea, which bear with great force upon the commercial and military importance of the canal to the United States. Concessions of such value and importance that have already commanded an expenditure of more than $5,000,000, wisely and economically employed in permanent work on the canal, under the careful direction of private enterprise, must be worth more to the owners than the money they have expended, and will command a greater sum in the market if they are offered for sale to all bidders.

To the United States, in a political and strategic view, and as a sea route to our Pacific coasts, shortened by more than half the length of the present ocean route, this waterway is of greater importance than the Suez Canal is to Europe and Great Britain, or than the freedom of the Bosphorus would be to Russia.

As a competitor with Great Britain and other transatlantic nations for the commerce of the Pacific Ocean, this canal is indispensable to the United States.

On these points, also, the previous reports of this committee were quite full, and they supply the data for almost exact estimates that any one can easily make, and need not now be repeated.

A general view of the geography of the coasts of the Atlantic and Pacific oceans and the lands that lie between them leave no room for doubt that the amount of tonnage that must pass through this canal will, almost in the beginning, equal that which now passes through the Suez Canal, and will be, in the near future, very much greater.

The exchange of commodities between the eastern coasts of America and the eastern coasts of Asia, and of Japan and the islands of the Pacific Ocean, which will seek the transit through Nicaragua as the shortest and most open route of navigation, will, of itself, supply more tonnage to pass through this canal than all that now passes through the Suez Canal.

The trade between these countries will be more direct than it is now, with London as the common point of distribution, and will therefore be cheaper than the present system. The Nicaraguan Canal will thus be given the preference over the Suez Canal by merchants and navigators. When we add to this the traffic that will pass in ships between the Eastern and Western coasts of the American hemisphere, the amount of tonnage that will pass through the Nicaraguan Canal must be largely in excess of that which will find its way through the Suez Canal. A carefully prepared statement is appended to this report, marked Exhibit No. 3, which shows the value of the commerce that is tributary to this canal.

The Cordillera range of mountains, extending the entire length of South America, forbid the hope that the eastern and western coasts of that continent can ever interchange their commerce by means of railways so as to make it advantageous.

Although the United States and Canada have, in a measure, overcome the like, but less difficult, obstructions of their mountain ranges, by driving railroads across them, the expenses of transportation are so heavy that they practically forbid commerce between the Eastern and Western coasts of North America.

On this account, the commerce between the eastern and western coasts of Mexico by rail is not considerable, and as to Canada, it is trifling; while as to the United States it is greatly below its proper value, and our Pacific-coast commerce is seeking ship communication with Europe around Cape Horn and through the Suez Canal at a destructive loss of time and interest, and an increase of freights and of damage by long journeys on the ocean through all seasons and climes.

"The ship's journey around the Horn" is a distress to commerce that the civilization of the age requires to be removed, and the route through Nicaragua is the only possible remedy for this universal evil.

It is not too much to say that this condition, so easy to be remedied, will be a reproach to the men of this age if some active and decided movement is not made to relieve against it.

To point out the dangers, hardships, loss of time, and the destruction of life and property incident to this only waterway connecting the Atlantic and Pacific oceans, which must be navigated in the roughest seas and the most inhospitable climate in all the world, is only to repeat the experience of seafaring men for ages past, and to evoke a prayer from them that the United States will do its obvious duty towards them.

THE STRATEGIC VIEW OF THE CANAL.

The importance of the Nicaragua Canal to the United States in a military and strategic view would demand of us an expenditure of ten times the sum that it will cost to build and protect it. Germany and Great Britain have already occupied every island and harbor in the Pacific Ocean south of the Alaskan peninsula that is a fit place for a naval station or for dock yards, except in Hawaiia and the harbor of Pango Pango, in Samoa.

On these we seem to have a feeble hold. On the southern and eastern seas that wash our coasts, these powers and Spain have occupied and have strongly fortified every available harbor from Honduras to Halifax. The greater number of these naval strongholds are established for no purpose of protecting or defending any European power.

Those in the Atlantic waters and Carribean Sea are intended to control the United States in her military operations, while those in the Pacific Ocean are intended to hold military control over the Western shores of both the American continents. The United States is completely circumvallated, on the north by British Possessions and the frozen ocean, and on the east, south and west by these military posts.

The embarrassment of this situation, not to say its danger, ought to excite our earnest attention, at least to the finding of some way to avoid it, if we can not get our consent to overcome it. In our efforts so far to provide some safeguards against a strong and inflexible aggression that moves with a settled purpose to gain every point where advantage is to be found, and to hold it, we have expended, possibly, more money, but with less effect, than European powers have expended to encompass us with fortified naval stations near our coasts as bases of supplies for their fleets.

From these the most powerful ships of war can assail our harbors, and retire to cover in case of necessity, while the United States must double Cape Horn in sending assistance from our eastern to our western coasts.

With the canal at our command we need not have two fleets to protect our coasts, as we are now compelled to do, at a cost already excessive and is greatly to be increased. Without the canal we are, relatively, in a situation of deplorable weakness.

COMPARED WITH THE SUEZ CANAL.

When private enterprise in Southern Europe first addressed itself to the task of opening a sea-level canal through the Isthmus of Suez, there was no lesson of experience to guide the movement or to assure its success. After a time the Khedive of Egypt, without the firman of his suzerain, the Sultan of Turkey, supported the undertaking and put heavy burdens on his people to sustain it.

This wise and heroic decree of the ruler of a government nearly relapsed into barbarism secured the Suez Canal and should have secured the inviolable independence of his country. But the value of the canal to commercial and political aspirations for dominion attracted the cupidity of Great Britain and has drawn that great and costly work and the independence of Egypt into the grasp of that Empire.

If it shall result, from our indifference or dread of expansion in the direction of national duty and of self-preservation, that Great Britain or any other great European power shall get the control of the concessions that we have, so far, refused, the result is even now plainly manifest, that the Central American States will repeat the experience of Egypt.

Then we shall have our country broken in its coast line of trade and defenses, by a European power, not in violation of the Monroe doctrine, but this will be done in the name of these Republics on and near the line of the canal. The precedent for this line of action is already established in the moral forces that keep Great Britain in control of the Mosquito Reservation in Nicaragua, and in the actual sovereign assertion of right and power over The Belize and the Bay Islands, against which we have "protested overmuch."

This is said to be impossible without our defeat in war. But why should we answer with a threat of war an aggression that can be avoided, or repelled, by the guarantee of the bonds of a company seven-tenths of whose stock is owned by the United States?

An examination of the financial value of the canal will show that it is to be the best great property in the world. The Suez Canal is an unquestionable proof of this statement, and we add to the former statements of the committee, on this point, the following facts:

SUEZ CANAL.

The Suez canal is 87 miles long, 66 of which are actual canal, the other 21 miles being lake navigation. The canal and its appurtenances were completed on or about the 1st of January, 1870, and cost about $91,000,000. Since that time there have been expended for betterments and improvements, including the deepening of the channel, about $24,000,000 more; bringing the total cost of the canal up to about $115,000,000. The canal was originally 26 feet deep. Its present depth is 28 feet. The canal to-day is capitalized at about $90,500,000 in stock and obligations. The difference between the cost and its present capitalization in stock and bonds was made up by receipts from various sources applied to construction and improvement account.

It is commonly reported that the actual cost of construction did not exceed $50,000,000.

The following statement shows the number of ships and net tonnage which passed through the Suez Canal, and the gross receipts therefrom, from 1870 to 1892, inclusive:

Year.	Number of ships.	Net tonnage.	Gross receipts.
			Francs.
1870	488	436, 600	4, 345, 758
1875	1, 494	2, 009, 984	26, 430, 750
1880	2, 028	3, 057, 421	36, 492, 620
1885	3, 624	6, 335, 752	60, 057, 259
1890	3, 389	6, 853, 637	68, 983, 500
1891	4, 206	8, 699, 020	83, 421, 504
1892	3, 559	7, 712, 028	74, 888, 561

The cost of administration, operation, and maintenance of the canal for the years 1888 to 1892, inclusive, was as follows:

1888 (about)	$1, 200, 000
1889 (about)	1, 350, 000
1890 (about)	1, 375, 000
1891 (about)	1, 475, 000
1892 (about)	1, 435, 000

A large proportion of these expenses were incurred by the dredging made necessary to relieve the canal from the drifting sands of the desert which accumulate.

The actual net revenues of the company for a series of years past have been upwards of $12,000,000 annually. The net profits in 1892 were 41,728,543 francs, or about $8,345,000, and the dividends declared for said year were 19·8 per cent, including the taxes retained for the sinking fund.

The shares of the company, originally issued at 500 francs each, are quoted on the Paris Bourse at 2,692.50 francs.

The shares of the Suez Canal held by the English Government and purchased for £4,000,000 are worth to-day over £19,000,000 in the open market.

The business of 1892 and 1893 suffered from the general commercial depression throughout the world, and was lighter than that done in 1891. In the said last-mentioned year the net profits were 49,091,892 francs, or about $9,800,000, and the dividends declared on the stock that year amounted to 22·4 per cent.

The effect of the Suez Canal upon the commerce of the world is apparent from the fact that whereas in 1870, the first full year of its operation, there passed through the canal 486 vessels, registering 436,600 tons, the number of vessels passing in 1891 was 4,207, registering 8,700,000 tons.

The most significant fact in this enormous increase is that the average size of the vessels using the canal in 1870 was but little over 1,300 tons register, while in 1891 it had increased to over 2,090 tons, and in 1892 to 2,200 tons.

The outside limit of the cost of the Nicaraguan Canal is $100,000,000, but the committee assume, in correspondence with the estimates that have been so carefully made and revised, that the cost will not exceed $70,000,000, and that, if it should, there will be a fund in the treasury of the company from the sales of stock remaining undisposed of equal to $16,000,000, in all $86,000,000. This stock will go to par as soon as the construction of the canal is resumed, if not as soon as Congress has provided for the guaranty of the bonds of the company.

THE ADVANTAGES AND RISK.

The advantages to be derived from the ownership by the United States of $70,000,000 of the stock of this company will be a boon to the people that is not equaled by the benefits of any work of a public character in which the United States has ever engaged. It is a free gift to the country, which the enterprise, courage, and skill of a few earnest men has placed in reach of the Government that it could never have acquired through diplomatic effort. Under the treaty made with Nicaragua by Secretary Frelinghuysen, the profits to be derived by the United States from the canal tolls were not nearly so great as they would be under the bill now reported, while that concession was to be at a cost of $5,000,000; and in the arrangement proposed by this bill, the United States gets $70,000,000 in stock that is worth more than the stock in the Suez Canal, without cost and without danger of liability.

It is entirely improbable that the Treasury of the United States will ever be required to advance any money either for the construction of the canal or for the payment of interest on the bonds, even while the canal is in process of construction. The interest on the bonds, even after $70,000,000 has been expended, is $2,100,000 per annum. If it requires seven years to complete the canal, the issue of bonds required will be about $10,000,000 each year: that is, $300,000 the first year, $600,000 the second year, $900,000 the third year, and so on, until the seventh year, when the sum needed to meet the interest would be $2,100,000. At that time the canal will be opened and in full operation, and its income even for the first year will reach $5,000,000, at the rate of tolls now received by the Suez Canal.

At the beginning of each quarter the bonds required to be guaranteed and sold will cover the interest to accrue during that period, and there can be no doubt that the accruing interest will thus be provided for in every case. Under the plan of this bill it is scarcely possible that the Treasury of the United States will ever be called upon to supply a dollar of money to the canal beyond the small sums that are required to meet the expenses of the Government inspections required by the act, and these will be made by naval and military officers, in almost every instance, who are already in the pay of the United States.

When Great Britain, after the Suez Canal was completed, saw her advantage in the investment of £4,000,000 in its stock, there was only a vague impression that it would result in a profit, in money, yet in about fifteen years that has increased nearly 400 per cent, and is paying an annual dividend of over 22 per cent.

It is impossible to avoid, or to discredit, the weight of this fact of actual experience, in a matter that is so nearly a case in point. The only difference in the two canals, as earners of profit, is that the Nicaraguan Canal has a vastly wider and more lucrative field of commerce from which to draw its revenues than can be relied upon by the Suez Canal.

Can it be expected that Great Britain will cease its efforts to gain control of the Nicaraguan Canal, and to hold the keys to the equatorial belt of commercial dominion that reaches around the world, when her experience in controlling the Suez Canal has brought to her, in less than a quarter of a century, such increase of profit in money, and such extension of commercial and political power?

One of these new gateways of the commerce of the world must belong to Americans and be under American control. Private enterprise and capital can build them, but they must be under national care, and be kept open by a powerful arm for equal international use.

The Government of the United States and our responsible men of this day will have a severe reckoning with posterity and with their political opponents, if the example of Great Britain goes unheeded and her manifest policy to dominate the commerce of the world is quietly permitted to prevail, to the dishonor of our country and the disappointment of the hopes and desires of the people of the Western Hemisphere.

DIPLOMATIC AND OTHER OBJECTIONS.

In the former reports of the committee the right of Congress to engage in this work has been sufficiently discussed.

There seems to be no objection urged at this time, except that it is not a wise policy of our Government to do anything for our Navy, or for our national defense or protection, or for our commerce except within our own borders. What will we do to protect the fur seals under the restrictions of such a policy?

Objection has been made that the Maritime Canal Company of Nicaragua is a private corporation, whose bonds the United States is asked to guarantee. In law and in fact this is a wholly untenable statement. Private individuals can not own more than 7 per cent of the stock of this company under the provisions of this bill. The United States, under the bill now reported, will own 70 per cent of the stock, Nicaragua will own 6½ per cent, and Costa Rica will own 1 per cent of the stock.

So far from this being a private corporation, or one for the benefit of private persons, three independent governments will own 77½ per cent, the Maritime Company 16½ per cent, and private persons may own 7 per cent of the stock.

These facts completely answer these objections; but, if more was needed, the concessions and charter of the company declare this to be a public act throughout, and the representatives of the stock owned by three sovereign republics sit as directors at the council board of this company.

No corporation connected with a business subject could be more completely a public corporation than this is. Not only is it a corporation to promote public ends, but it is also international in its scope and purposes, and nearly municipal in its authority over a neutral zone in Nicaragua and Costa Rica, fixed by the concessions, and supported by grants of authority that affect all maritime nations.

No diplomatic relation of the United States is in the least degree affected by its participation in the promotion, assistance, and control of the Maritime Canal Company of Nicaragau, under the provisions of the bill as it is now reported to the Senate.

Our powers in Panama for the protection of the isthmian transit are not greater than those guaranteed to the United States in our treaty with Nicaragua for the protection of a canal through the territory of that Republic.

Under such authority, the United States has, on several occasions, landed troops at Panama to protect the railway across the isthmus, built by citizens of the United States under a charter granted by New York. This incursion of military forces into Panama has created no friction and has not excited any feeling of uneasiness there or in any other quarter.

The attitude in which the United States is placed, in respect of this canal, and as it is defined in the bill now reported to the Senate, is in accordance with all of our treaty rights and obligations with all countries, and it can not be a just cause of uneasiness to any power in the world.

All commercial nations are deeply interested in this canal, and none of them have intimated a doubt as to the faithful observance on the part of the United States of the limitations contained in the concessions of Nicaragua and Costa Rica for this waterway of nations.

It would be idle for us to hunt for objections where none exist on the part of other nations to our close relations with this canal company. It has been more than five years since Congress, through one of the committees of the Senate, began to deal with this canal in a serious way, and during all of that period the work on the canal has been steadily progressing under the charter which is proposed to be amended by this act.

Ample time and opportunity has been given to other nations to make objections to any action of the Government of the United States in relation to the canal, if any objection has ever been contemplated by them. All this business has been transacted without the least effort at concealment. The committee have not found any embarrassment to this work in our relations with foreign countries. On the contrary, every treaty we have, that relates to the canal, provides for and supports the attitude in which the bill now reported places the United States in reference to this great international work.

STOCKS AND BONDS OUTSTANDING.

The bill herewith reported to the Senate deals exclusively with the Maritime Canal Company of Nicaragua, an organization that is expressly provided for in the concessions of Nicaragua and Costa Rica, and is therein distinctly forecast as the protegé of the United States.

The bill requires that all outstanding stocks issued and obligations for the issue of stocks or bonds shall be canceled, and all existing debts and demands against the company shall be extinguished, and all contracts for work to be done, or materials to be furnished, shall be taken up before this act shall take effect, so as to have the company free of all debts and demands at the time of its reorganization under this act.

The Secretary of the Treasury is empowered to render a final decision as to all sums to be paid to the Maritime Company for its property and to enable it to pay its outstanding debts and obligations. The stock liabilities and the concessions, with all their incidents and all outstanding obligations for the delivery of bonds of the company, are to be paid for in the stock of the company, not to exceed $7,000,000, or such smaller amount as the Secretary of the Treasury shall determine to be just and equitable.

On the faith of these obligations and stocks, the construction company, which was employed to complete the canal at a total cost of $220,000,000, in the stock and bonds of the Maritime Company, advanced and expended in surveys, plant, machinery, materials, labor, and salaries, with interest, a sum of money alleged to be equal to $4,500,000.

This bill requires the Secretary of the Treasury to state an account with the Maritime Canal Company, as to all the items of these cash expenditures and to determine, finally, the amount thereof, and to deliver the bonds of the company guaranteed by the United States, to an amount equal to the sum so ascertained and determined, not to exceed $4,500,000, and to have the same applied to the liquidation and extinguishment of all demands upon the company for such cash expenditures. In explanation of the actual situation of the Maritime Company, with reference to these matters, the attorney of that company submitted to the committee the following:

STATEMENT.

"The bill provides that the Maritime Canal Company shall have not exceeding $4,500,000 in guarantied bonds, and not more than $7,000,000 in stock, with which to call in and cancel the following securities issued by it from time to time, to wit:

Stock issued to subscribers for cash, $1,014,500.
Stock paid for concessions, $12,000,000.
Stock paid for work, $3,504,900.
Scrip issued for bonds paid for work, $6,855,000.
In all, $23,374,400.

"In addition to the redemption of these stocks and outstanding obligations for stock and bonds the Maritime Company is required to procure the construction company to the cancellation of the contract of January 3, 1890, its most valuable asset.

"To carry out the above requirements the consent of the construction company and of its stockholders, as well as that of the other persons holding securities of the Maritime Canal Company, must be obtained before the provisions of the bill can be carried into effect.

"The bulk of the securities to be redeemed are now held by the construction company, but about $1,300,000 of the stock of the Maritime Company and $1,300,000 of obligations for Maritime Company bonds are held by persons not connected with the companies, who are not likely to part with the same for less than par, no matter how much less they paid for them.

"The stockholders of the construction company will doubtless consent to any fair and equitable provision which will give them a fair return upon their investment. The construction company has raised and expended, under its contract with the Maritime Canal Company, about $4,451,568, which represents about $4,404,900 of Maritime Company stock and about $6,855,000 of Maritime Company bonds to be issued to them. One million dollars of the stock of the Maritime Company was sold to the construction company for cash, at par, and the balance of said securities were issued, or agreed to be issued, under the contract with the construction company for building the canal, of date January 3, 1890.

"In addition to these amounts the construction company acquired $12,000,000 of maritime company stock in payment for the concessions. This amount included the $6,000,000 of stock to which the promoters are entitled under the concession from Nicaragua.

"If this bill becomes a law, and if the Secretary of the Treasury, under its provisions, so decides, the Maritime Company would have $4,500,000 in bonds with which to pay its cash obligations, resulting from the recision of the contract with the construction company, for completing the canal, and $7,000,000, in stocks, to redeem $6,855,000 of its obligations for bonds.

"Of this sum, $1,300,000, or thereabouts, are in the hands of the public and can only be redeemed at par.

"The stockholders of the construction company, in consenting to surrender for cancellation the securities held in their treasury, would, therefore, probably receive no more than $3,200,000 in cash for $4,451,568 *expended on* the canal work, [illegible] 700,000 in stock for their concession sold to the Maritime Canal Company. The construction company, in order to raise money to work on the canal, had to sell the securities paid to them by the Maritime Company at much less than par, so that the sum realized from their sale is much less than they will have to pay for their redemption, and they must, therefore, sustain a heavy loss on the whole transaction. It is equally obvious that the Maritime Company must be in a position to do equal justice to all the holders of its securities without distinction, in order to call them in and cancel them, as is required in the bill to be reported to the Senate."

The difficulties to be met in this reorganization of the Maritime Canal Company under this proposed amendment to its original charter have been very great, and involve very considerable sacrifices on the part of the company as it is at present organized, but the committee are assured that all that is required in this bill will be speedily accomplished.

A company that is willing to accept this pittance of stock and bonds for the valuable rights and concessions thus placed within the power of Congress, involving a large loss to individuals, is entitled to credit for something more worthy of their enterprising and patriotic spirit than to be regarded as a body of adventurers anxious to get rid of a bankrupt concern.

The concession of 70 per cent of paid up stock to the United States, when the present owners get not exceeding 7 per cent, is not a very slight matter, at least to them.

Under their concession from Nicaragua they are entitled to $6,000,000 paid up stock, all of which they surrender in order to get $7,000,000 of stock with which to free the Company of all stock already issued and all outstanding obligations for bonds and stock, amounting to over $16,000,000.

CONCLUSIONS.

In view of these facts, and of the certainty that the property of the Maritime Canal Company is of immense value and can be sold to foreign syndicates at a sum far greater than is provided in this bill, the committee feel constrained to declare that, in their opinion, the conduct of all who are financially interested in the canal and concerned in the effort to place this subject under the control of Congress is free from selfish purposes, and is honorable to them, and is entitled to be regarded as a patriotic sacrifice on their part.

This bill provides for the guaranty of $70,000,000 of bonds of the Maritime Company, bearing 3 per cent interest, payable quarterly, the principal to fall due in not less than ten, nor more than thirty years. This reduction of the amount of bonds to be guaranteed, below the $100,000,000 provided in the previous reports of the committee, is in nearer accord with the estimated cost of the canal, and it leaves 70 per cent of the entire capital stock of the company in the ownership of the United States, and 16½ per cent in the treasury of the company; to all of which resort may be had, in case of necessity to raise any additional sum, if any is required, to complete the canal.

The safeguards provided in this bill to prevent any possible injury to the United States that is within reach of the most cautious forecast, are chiefly as follows:

1. The United States, at all times and in all conditions of the company, is to appoint ten of the fifteen members of the board of directors,

and all the expenditures and operations of the company are to be under the general supervision of the Secretary of the Treasury.

2. The President may, at any time prior to July 1, 1897, suspend the issue of guaranteed bonds until Congress shall otherwise direct. After that time the condition of the work will, it is believed, be so far advanced, and its practicability will be so well established, that this authority will no longer be useful.

3. The power of foreclosing the mortgage of the company, by sale, upon the order of the President and without judicial proceedings, is a reservation of the means of summary disposal of the mortgaged estate, that may be found useful.

4. The President may, in his discretion, appoint a board of three engineers, to inspect the canal and everything connected with it, before any bonds are issued under this act.

5. All work on the canal as it progresses is to be examined by inspectors appointed by the President of the United States, who shall certify quarterly to its actual cost, before any guaranteed bonds are delivered to the company in payment for it.

6. No money raised by the sale of bonds or stock of the company shall be applied otherwise than to the cost of the construction and equipment of the canal.

These general safeguards, provided to insure careful progress, faithful administration, and honest conduct on the part of all persons who may be connected with the work of building the canal, are supplemented by other provisions of like character relating to the details of the plan and purposes of this act.

The present moment seems propitious for opening this waterway that is indispensable to our physical and political geography, and to the proper care of the Government for the protection and prosperity of our Pacific coasts.

The plan and certain effect of this bill, if it becomes a law, will be to put into active business employment $100,000,000 of money borrowed from our own people, without risk to the Government. Such a movement at this time would stir all industries into activity and release other hundreds of millions of dollars that are now being hoarded or employed in gambling in stocks. It would furnish good and wholesome employment to 50,000 Americans that are marching on the highways, begging for work and often for food.

It would yield to the United States, at the rate of one dollar per ton for canal charges, not less than $4,000,000 per annum of dividends on its $70,000,000 of stock in the canal.

With this fund, if so applied, we could grant, or pay, to our coastwise navigators the full amount of tolls they would have to pay to the canal. Or, if we chose, we could, with these earnings, build a ship canal for military and commercial purposes to connect the Great Lakes with the Gulf of Mexico, through the Mississippi River.

If we can afford to pay interest on $100,000,000, locked up in the Treasury to protect our national credit, we could even better afford, if that was a necessary result, to pay interest on $70,000,000 to save to our commerce between the Atlantic and Pacific States the average distance of 10,000 miles, in every voyage, and the crossing of the torrid zone twice in the journey, going out, and twice on the return trip, and the passage through the dreadful seas of the Antarctic Ocean.

The committee adheres to the estimate of the annual earnings of the Nicaraguan Canal, made in their former reports, as the minimum sum that will probably be realized from tonnage tolls and passengers, although the facts now in view indicate a much larger sum than $9,000,000, at the rate of $1 per ton, while the Suez rate is more than $2 per ton. This would pay 3 per cent interest on $70,000,000, amounting to $2,100,000, and cost of maintenance and current expenses $3,000,000, and would leave for dividends $3,900,000, of which seven-tenths would belong to the United States.

EXHIBIT 1.

[Senate Ex. Doc. No. 1, Fifty-second Congress, second session.]

LETTER FROM THE SECRETARY OF THE INTERIOR, TRANSMITTING THE ORIGINAL REPORT OF THE MARITIME CANAL COMPANY OF NICARAGUA.

DEPARTMENT OF THE INTERIOR,
Washington, December 5, 1892.

SIR: I have the honor to transmit herewith for the information of the Senate the original report of the Maritime Canal Company of Nicaragua, submitted to this Department this day, in accordance with section 6 of the act of Congress approved February 20, 1889, entitled "An act to incorporate the Maritime Canal Company of Nicaragua."

Very respectfully,

JOHN W. NOBLE,
Secretary.

The PRESIDENT OF THE SENATE.

THE ANNUAL REPORT OF THE MARITIME CANAL COMPANY OF NICARAGUA.

The SECRETARY OF THE INTERIOR:

SIR: Pursuant to section 6 of the act entitled "An act to incorporate The Maritime Canal Company of Nicaragua," approved February 20, 1889, which provides that said company shall make a report on the first Monday of December in each year to the Secretary of the Interior, and in accordance with the instructions received from you prescribing the form of such report and the particulars to be given thereby, the said Maritime Canal Company of Nicaragua hereby reports as follows:

First. That the regular annual meeting of the company was held at No. 44 Wall street, in the city of New York, on the 3d day of May, 1892, pursuant to the provisions of the by-laws, and that at such meeting Messrs. Charles P. Daly, Daniel Ammen, Horace L. Hotchkiss, Henry E. Howland, and James B. Eustis were duly elected directors of said company to fill the places made vacant by the class whose term of office expired on the said 3d day of May, 1892, and to serve for the period of three years, as provided for in the said act of incorporation.

Second. That the board of directors of said company, as now constituted, is composed of the following stockholders:

Class of 1893.—Joseph Bryan, James Roosevelt, Hiram Hitchcock, Thomas B. Atkins, and Horatio Guzmán (Nicaraguan director).

Class of 1894.—Alfred B. Darling, Franklin Fairbanks, C. Ridgley Goodwin and Alexander T. Mason.

Class of 1895.—Charles P. Daly, Daniel Ammen, Horace L. Hotchkiss, Henry E. Howland, and James B. Eustis.

A majority of the above-named directors are citizens and residents of the United States. The vacancy existing in the class of 1894 has not yet been filled

Third. That at the first meeting of the board of directors held after the said annual election, the following officers were duly elected to serve for the ensuing year, to wit: President, Hiram Hitchcock; vice-president, Charles P. Daly; secretary and treasurer, Thomas B. Atkins. All of the officers so elected are citizens and residents of the United States. That at said meeting the following directors were elected members of the executive committee, as provided for in the by-laws of said company, to wit: James Roosevelt, chairman; Hiram Hitchcock, Horace L. Hotchkiss, C. Ridgley Goodwin, and Alexander T. Mason.

Fourth. That the interests of this company are at present represented in the Republic of Nicaragua by Mr. Gonzalez Espinosa, as resident agent at Managua; while Mr. Louis Chable represents the corporation in a similar capacity at San Jose, in the Republic of Costa Rica.

Fifth. That on the 11th day of December, 1889, in accordance with the provisions of section 1 of the said act of incorporation, a certificate of the appointment of Messrs. Daly, Hoyt & Mason, counselors at law, of No 44 Wall street, in the city of New York, as the attorneys of the Maritime Canal Company of Nicaragua, was duly made by the president of the company and filed in the office of the Secretary of State of the United States, and said firm are still the legal representatives of said corporation.

Sixth. That since the organization of the Maritime Canal Company of Nicaragua 10,145 shares of the capital stock of said company have been subscribed for at par, amounting in the aggregate to the sum of $1,014,500, of which amount $1,001,450 have been paid into the treasury in cash; that there has been paid into the treasury from other sources $39,299.70, making the total amount of cash received $1,040,749.70; that the other assets of the company consist of its capital stock, of the concessions, rights, privileges, and franchises which it now owns, and of the plant, equipments, materials, lands, buildings, structures, railways, steamboats, telephone and telegraph lines, dredges, locomotives, cars, machinery, stores, machine shops, supplies, and other property in Central America, including the lands situated between the lake and the Pacific, which we purchased from the Government of Nicaragua for the route of the canal, at a cost of $50,000, in accordance with the provisions of the Nicaraguan concession.

Seventh. That since the organization of the company it has paid for property, work and labor done, and materials furnished in the execution of the work of constructing the canal and in administration expenses, the sum of $815,649.63 in cash and 31,990 shares of the full-paid capital stock of the company of the par value of $3,199,000, and is obligated for $6,855,000 of its first-mortgage bonds. It has also issued 180,000 shares of its capital stock of the par value of $18,000,000 in payment for concessionary rights, privileges, franchises, and other property.

Eighth. That the liabilities of the company consist of the amounts still due under the concessions granted to the company; of the $6,855,000 of bonds before mentioned, the said bonds being due to the Nicaragua Canal Construction Company for work and labor done and materials furnished in the execution of the work of constructing the Interoceanic Canal, and of cash liabilities outstanding and unpaid to an amount not exceeding $50,000.

Ninth. That while the work of actual construction was not formally inaugurated until the 8th day of October, 1889, preliminary work on the canal was commenced on the 3d day of June of that year, since which time operations have been prosecuted with diligence and energy. The following statement covers the period that has elapsed since the last-mentioned date and shows what has been accomplished by the company in Nicaragua since the inception of the canal work up to the time of this report.

The axial and detailed surveys of the proposed interoceanic canal, its harbors, locks, and other accessory work, were completed early in the spring of 1889, and the final location of the route from ocean to ocean practically determined. Several months elapsed after the completion of this work before the voluminous plans and drawings prepared by the company were approved by the Government of Nicaragua and the formal commencement of construction authorized, during which time a corps of engineers was kept constantly employed and much valuable preparatory work was done, such as the commencement of the erection of permanent quarters, wharves, storehouses, clearing the ground, and accumulating supplies, tools, machinery, etc.

The necessity of securing a safe entrance from the Atlantic to the old port (which, until 1860, was easily accessible to vessels of upward of 20-foot draft) was realized as indispensible to economical and rapid progress, and therefore the first work of actual construction was in execution of the engineers' plans for restoring the harbor. One of the means to accomplish this end was the erection of a breakwater to protect the entrance. This massive work, which will ultimately absorb much of the rock excavated from the divide cut, has been pushed out about 1,000 feet and has been filled in with brush mattresses, rock, and hydraulic-cement concrete. Quarters for accommodation of the workmen and storage for supplies were erected near this work, and a railroad track has been laid upon the breakwater and extended landward to facilitate the handling of building material and other supplies. In the framework of this breakwater creosoted piling only was used, as the marine worm soon destroys unprotected wood. The filling placed within and beneath the heavy creosoted timber framework forms a solid mass of what would otherwise be insufficiently protected from injury by the elements and by the teredo. The bar in front of the old San Juan harbor has, since 1860, been one of the most difficult on the coast.

The breakwater was constructed from the beach to and across this bar, and although it encountered the full force of the waves, it was carried forward through the heavy surf without interruption on account of the weather and without accident of any kind. As it advanced it afforded a partial shelter to the beach to leeward and also served as a barrier to the moving sand, which, impelled by the currents and prevailing winds and driven constantly to the westward, built up and maintained the sand spit that thirty years ago closed the old port of San Juan. This artificial interruption to the operation of the winds and current permitted countervailing forces of nature to come into play, so that by the time the pier had been pushed out 600 feet the sand beach under its lee was swept away and a channel formed communicating from the open ocean to the old harbor and restoring it to the extent of permitting the entrance of light-draft seagoing vessels at a point where, six months before, there was a sand bank 3 or 4 feet above the sea level. The attainment of this result was without the assistance of any dredge or any artificial aid other than that afforded by the breakwater.

It is evident from this experience that the plan of the engineers for the restoration of the port of San Juan is not only theoretically sound, but practicable. The building of the pier has steadily progressed as materials were available, and its total length, as already stated, is now over 1,000 feet. The depth of the channel under the lee of the pier reached 10 feet when the structure had been extended 800 feet. In the winter of 1890–'91 a dredge increased this depth to about 15 feet, which has since been maintained, except in restricted areas, which are easily deepened by dredging. The first deep-sea vessel to enter the restored harbor was the steamer *Sverdrup*, with a cargo of machinery, etc., on the 7th of January, 1891, and since then many other vessels have frequented the port.

The construction of permanent buildings was begun in the summer of 1889 and has been in progress ever since. The completed structures are all of wood (pine from the United States) and are roofed with corrugated galvanized iron. The offices, quarters, and hospitals are neat and comfortable, being ceiled and painted and provided with wide verandas outside. The permanent buildings thus far erected are in the immediate vicinity of San Juan, where the general headquarters are located and where the most important operations have been concentrated. They consist of five groups, covering an area of about 1¾ acres, and have a floor space as stated below:

	Square feet.
Headquarters	13,986
Hospital	14,174
La Fé depot	21,864
Railroad headquarters	18,778
Camp Cheney	7,100
Total	75,902

Besides the above, numerous and extensive wharves equipped for unloading freight, sheds, small outhouses, water tanks, etc., have been constructed. The machine and smith's shops are equipped with a varied and extensive assortment of modern tools. A tramway connects the more important of these establishments.

Work in clearing the canal line of forest growth was begun near Greytown in January, 1890, and for a distance of about 10 miles back from the coast a clearing has been made of 486 feet in width. Similar work was commenced on the west side of Lake Nicaragua in the month of November, 1890, and for 9 miles the ground there is ready for construction work.

A telegraph line to the interior, connecting with the telegraph systems of the country and the ocean cables, was one of the first works commenced, and it was soon pushed through to Castillo, covering with its loops a distance of 60 miles. For the first 10 miles the line ran across a very difficult swamp, where the work was most arduous; the poles of native timber were difficult of procurement; and, together with all other supplies, had to be carried to where they were needed by men wading in water from 2 to 4 feet in depth. In some places the water was so deep that the poles could not be set in the earth at all, and in such cases they were secured to tree stumps, and otherwise supported by wire guys. Through the hill country the line was not only an expensive one to build, but is difficult to maintain, and to protect the wires and poles from damage by falling timber it was necessary to make a clearing of the forest along the line to a width of about 100 feet. In addition to this telegraph service, all the offices and the more important camps and stations are now also in telephonic communication.

As the heaviest single body of work to be accomplished on the whole line is concentrated within a distance of 3 miles at the rock-cutting, "The Eastern Divide," and as the time required to complete the canal will necessarily be measured by the time spent in opening this deep cut, it was considered important to install a plant for the work at the earliest date possible. The difficulties of transporting to the Divide the quantity of machinery, etc., needed for the heavy rock-cutting to be done at that point made requisite the immediate construction of a railroad. This work was commenced in the summer of 1890 and has been pushed forward with marked success. The line traverses what had always been considered an impassable swamp, and for the first 10 miles there are but 4 miles of hard ground. Soon after beginning the roadbed heavy rains set in and the swamp was flooded to a depth of from 1 to 4 feet. All the earth used for filling had to be brought from a distance by construction trains, which necessitated laying the track first and making the required embankment afterward.

To accomplish this, a heavy corduroy of logs was laid for many miles. These logs, which were procured from the neighboring forest, were rolled, floated, or dragged by man power alone to the line of the proposed track, and there laid transversely as compactly as possible. Upon them were placed longitudinal stringers, consisting of native tree trunks, on which the railroad ties were laid, and upon these the steel rails were then spiked down. Trains loaded with sand were run out over the structure and the sand dumped and packed into the interstices and under the ties, which were raised gradually by the workmen until the desired grade was secured. There were 6 miles in all of this construction through swamps, the men working most of the time in water reaching above the knees and often to the waist or armpits. The material used for grading and ballasting the first 8 miles of the roadbed was taken from the canal prism, near the harbor, and distributed along the line by construction trains, the cars being loaded by means of a steam shovel or navvy, capable of delivering 1,300 cubic yards per day.

There are several places along the railway where streams and other water courses are crossed. These are spanned by pile bridges, and a powerful steam pile-driver has been used in their construction. The portion of road already completed is the most difficult of the whole line, and but 7 miles now remain to be built to reach the Eastern Divide. There are several miles of side track, switches, etc., already in place, and the road is equipped for construction work with 4 locomotives, 50 cars, steam shovel, ballast-unloader, and all other requisite appliances. All the crossties and bridge timbers are of Northern pine, charged with 16 pounds creosote oil to the cubic foot. At the terminus on the harbor is a fine wharf, 264 feet long, built in the best manner of creosoted timber, and equipped with modern steam conveniences for handling freight rapidly. The survey for the remainder of the line, extending to the San Juan River at Ochoa, has been completed; in fact, two locations have been surveyed and profiles prepared in sufficient detail to permit accurate estimates of cost. Between Lake Nicaragua and the Pacific the railroad line is also located, and everything made ready for its construction, which must necessarily precede the inauguration upon a larger scale of the work of excavation.

In the summer of 1890 there was purchased from the American Contracting and Dredging Company the extensive and valuable plant used so successfully on the eastern end of the Panama Canal from the year 1881 to the callapse of that enterprise in 1888. The property consisted of seven dredges, the most powerful ever built, two fine tugboats, twenty lighters, several launches, the equipment of an entire machine shop, stationary engines, pumps, and a vast quantity of tools, spare parts, materials for repairs, etc. Many of the articles are in quantities which will suffice until the completion of the Nicaragua Canal.

During the autumn of 1890 this dredging plant was transferred to San Juan del Norte, where portions of it were immediately equipped for work, and three of the dredges have since been in use for various periods, upon the canal proper, in the harbor, and in the entrance channel leading thereto. Dredging on the canal line west of the harbor has uninterruptedly been carried forward and a point well inland has been reached, by an open channel 17 feet deep and varying in width from 150 to 230 feet, which drains the swamp and lowers the level of the swamp waters, thereby securing for the railroad embankment immunity from injury by flood waters. No obstructions to free dredging have been encountered so far, although the canal has now been opened for a distance of about 8,750 feet. A powerful seagoing suction dredge for deepening the channel across the bar has been constructed in Scotland for the company and is now ready to be sent to its destination.

The floating plant has been kept in repair, and the buildings, offices, quarters, and hospitals maintained in good condition, while the equipment of the machine shops is being increased as there is need.

All the engineers employed on the line have been and are of known and tried ability. Those in positions of chief responsibility have had extensive practice in works of engineering construction in the United States and the tropics. The engineers, administrative staff, surveyors, and nearly all the skilled mechanics have been hired in the United States and sent out under contract for at least a year's service, and several have been continuously employed in Nicaragua for upwards of three years. Natives of Central America and negroes from the island of Jamaica have been employed for unskilled labor, and all employés have been not only housed and fed by the company, but also supplied with medicine and hospital attendance. The rate of wages paid to ordinary laborers varies from 20 to 30 soles per month, and it is evident from past experience that an abundance of acclimated labor, entirely *adapted* to the company's needs, is readily obtainable from the localities named.

No Chinese or other Asiatic workmen have been employed, nor will such be used upon the work in the future.

In the location of the canal line the route chosen from among the many tentative lines run was that which presented the fewest difficulties. No change from the location first decided upon has since been made, except as further examination and studies have demonstrated the certainty of betterments, either by shortening the length or decreasing the difficulties and cost of construction. During the past year one or more parties of engineers have been constantly in the field engaged in critical examination of the topography at certain localities where previous surveys had suggested that betterments in the location or design might be practicable. In some cases, after very close examination and study, their hopes proved unrealizable, but in one instance instrumental examinations have completely demonstrated not only the practicability, but the economy to result from a rectification of the line. The location previously adopted between the sites of Locks Nos. 2 and 3 involved a curve of large radius in the sailing line through the second Deseado basin. It is now discovered that this curve may be eliminated, with a saving in distance of upwards of 1,000 feet and a saving in earth excavation of upwards of 600,000 cubic yards.

A site for the Ochoa Dam has been located about a half mile below that originally chosen; should the borings yet to be made at this locality prove its suitability of foundation, without material increase of cost over that already assigned in the estimates, another curve in the sailing line may be eliminated and a large reduction in mass of excavation will be possible. A party of engineers has been for many months engaged in boring the strata at the proposed site of La Flor Dam, which is located about 3 miles from the Pacific terminus. Although their work at last advices had not been completed, yet the results already known demonstrate the certainty of securing a solid rock foundation for the dam and for the locks which are to be built at this point. This existence of a solid foundation of homogeneous limestone at an inconsiderable depth is regarded as very important, for it will permit the construction of a dam of less mass than would have been required on the clay foundation contemplated before the deep borings with the diamond drill had been made.

A party of engineers was also engaged for many weeks in further surveys for the minor canal required under the concession to be built between Lake Nicaragua and Lake Managua, for steamboat navigation, known as the Tipitapa Canal. This work, which is not of large magnitude, has now been so thoroughly studied that plans can be prepared for construction and everything made ready for its speedy completion within a short time.

At the Machuca Rapids, in the San Juan River, a considerable mass of rock has been removed, improving the navigability of the river at this point.

About two years have elapsed since the old port was reopened, and the correctness of the theories upon which the works for reopening and maintaining the harbor and its entrance were based has been thoroughly demonstrated to the satisfaction of the engineers. Hydrographic parties have been kept constantly at work, adding to their previous knowledge of tidal and other currents and in the preparation of charts showing the effect of the works of construction upon the coast line and the harbor.

In March, 1891, the Hon. Warner Miller, president of the Nicaragua Canal Construction Company, accompanied by a large staff, visited the Republic of Nicaragua and made a complete and thorough examination of the entire line of the canal and of the numerous works connected with the construction thereof. The reports received from this expedition were most gratifying, and showed that the work then accomplished had been done in a systematic manner, with all possible care, thoroughness, and dispatch, and within the estimates of the engineers.

In addition to the results already achieved, as hereinbefore set forth, the company has organized and established in Nicaragua a complete hospital service and has perfected the sanitary arrangements in and about its camps and headquarters. In the early part of 1889 the medical work was carried on by assistant surgeons located at different points along the canal route, but the department was not regularly organized until October of that year, when a chief surgeon was appointed and the hospital at headquarters was virtually completed and made ready for occupation.

This hospital at present consists of thirteen buildings, of which five are two-story structures surrounded by broad verandas. The remaining buildings of the group are one-story structures, for the most part built of wood. The total capacity of the hospital is 125 beds. It is situated on the beach, about 500 feet from the surf, and is equipped with a first-class pharmacy and operating room. Owing to the mildness of the climate, it is possible to provide perfect ventilation with a smaller number of cubic feet for each patient than would be considered necessary in a colder climate. In 1890 it was found necessary to erect, 8 miles up the railway line, at Camp Perez, a temporary hospital, known as temporary hospital No. 1, accommodating about 50 patients. This hospital consists of one large building, containing, in addition to the general laborers' ward, a pharmacy and nurses' room. A second building was erected for culinary purposes. Medical stations have been established and operated at different times at points remote from the hospitals, according to the necessities of the work.

During the time covered by this report stations have been established at Camp Francis, on the beach; Carazo, on the San Juan River; Poco-Mas-Arriba; Satisfaction, on the Deseado River; Lake Silico; San Francisco River, and at Railway Camp No. 1. These stations are all on the Atlantic division. On the Pacific division stations have been operated at different times at Rivas and Tipitapa. In connection with headquarters hospital, an efficient ambulance service has been maintained since the fall of 1889. The company has also operated a road ambulance to stations on the beach and a car ambulance between the hospital and La Fé, at which latter place connections were made with the railway terminus, the navigation docks, and the breakwater. On the railway line an ambulance caboose car has been in use since the summer of 1891.

Every possible precaution against the development of disease among the company's employés has been observed, such as watching for and removing all local causes and preventing, as far as possible, the entrance into camps from outside sources of the germs of contagious or epidemic diseases, and by an efficient quarantine service. Every surgeon, in his section, exercises the duties of a sanitary inspector and reports to the chief surgeon any necessary changes in the camps or other surroundings. A supervision of the food furnished employés and the mode of its preparation is maintained. When a new camp is built the surgeon of the station inspects the location and surroundings and sees that hygienic rules are observed in its location and construction. The station surgeon reports every ten days upon the sanitary condition of all camps in his station.

Another method employed for prevention of disease among the company's employés has been a thorough physical examination of all laborers seeking to enter the service. It is easier to prevent the entrance of disease than to eradicate it when once lodged, and the advantage of this practice has been proven by the considerable decrease in the percentage of sickness among employés since the adoption of the rules. The staff of surgeons necessary to carry out the complete and careful scheme of work inaugurated by the company has been regulated in number by the character of the work, number of employés, relative distance of camps, and methods of transportation.

There have been in the employ of the company since 1889, 1 chief surgeon and 10 assistant surgeons; also, 1 druggist and 2 assistant druggists. The other employés, including nurses, orderlies, cooks, ambulance men, etc., have varied in number from 20 to 30. There have been treated in the hospitals of the company during the past three years 2,364 patients. The total number of deaths was 35, making a total death rate of 1·48 per cent of cases treated. These deaths, however, include not only those due to climatic diseases, but also to accidents and chronic diseases among employés admitted to the company's service before the rules for a physical examination were adopted. The total number of deaths due to diseases that may be termed climatic were 17, or 0·72 per cent. From this record it will be seen that any existing opinion regarding the unhealthfulness of the climate in Nicaragua is erroneous. Far removed from the severity of the Northern winters, though geographically in the tropics, the temperature is moderate and equable throughout the whole year. The northeast trade winds temper the atmosphere and have a marked influence.

The mean temperature during 1890 was 77·25° F. In 1891 there was an extreme range of 28° from a minimum of 67° to a maximum of 95°, or a mean of 81° F. This difference of mean temperature was probably due to the decrease of the annual rainfall. It has been asserted that the country teems with fatal maladies and that the canal employés would be exposed to severe types of fever as soon as the work of excavation was commenced. This, however, has not proved to be the case, as an examination of the records and statistics kept by the medical department will show. The dredges have already advanced over a mile into the swamps without encountering anything but sand and light loam, which, exposed to the sun, produces no unusual sickness, and the borings prove that the soil as far as the foothills or the entire width of the swamp lands is of a similar character. Most of the diseases met with have been mild in type. This is especially true of bronchitis and pneumonia. The cases of fever are of the remittent or intermittent type, very amenable to treatment, and not of as long duration as in the United States.

No epidemic disease has visited the country since the work was begun, and the occasional reports which have been published in the daily press were without any foundation in fact. Chagres fever is entirely unknown as an epidemic disease, and in 1890, when a number of cases were brought on towing steamers in the service of the company from Colon to Nicaragua, every one taken to the canal hospital recovered, while of those admitted from the same ships to the Colon hospital a number died.

For the accommodation of a working force of 10,000 men there will be required two general hospitals of 150 beds each for both officers and men, resembling very closely the present headquarters hospital, and two of 100 beds each for laborers, the general hospitals being located, one at the eastern end, the other near the western end of the canal, and the laborers' hospitals at convenient points along the line. These will provide 50 beds per thousand men, which will be ample, excepting in case of an epidemic, when it would be necessary to erect temporary hospitals wherever needed. A field equipment for a couple of temporary hospitals which could be used in the event of such an emergency could be kept constantly on hand. A properly arranged ambulance department, developed from the present nucleus, and a druggist department similiarly developed fom the central store, with a pharmacy connected with each hospital, are all provided for in the general plans, which are already to be put into operation as soon as a larger development of the work of construction is determined upon.

In conclusion, it is proper to say that the medical organization and the system of sanitation inaugurated by the company has proved itself to be exceedingly valuable in maintaining a death rate which is not only very greatly below that of any other known large work of construction in its hospital records, but also is very materially below the death rates of hospitals in the United States, as the following figures will show: In 1890, at the New York Presbyterian Hospital, the death rate was 10·73 per cent; in the Roosevelt Hospital, New York, it was 9·76 per cent; and in the Orange Memorial Hospital it was 7·88 per cent, while in headquarters hospital of the canal company it was only 1·38 per cent. The system which has operated with such exceptional results during the last three years may reasonably be expected to work as satisfactorily in its extension.

The company has gone to its work of building the canal in a plain, unostentatious, systematic manner, and although nearly all accomplished to date may be described as preliminary work only, yet a very important advance has been made. The results may be summarized as follows:

WORK ACCOMPLISHED.

(1) The prosecution of the final surveys for location and construction and surveys for economical improvements as to details.

(2) The subterranean examinations of the strata requiring removal by means of borings with the diamond drill.

(3) The restoration of the harbor of San Juan del Norte to the extent of securing an easy entrance to the port for vessels of moderate draft.

(4) The construction of extensive wharves and landing facilities.

(5) The erection of permanent buildings for offices, quarters, hospitals, storehouses, shops, etc., having a floor area of an acre and three-fourths.

(6) The building of a large number of temporary camps along the line for accomodation of employés.

(7) The completion of a telegraph line permitting ready communication with the work.

(8) The clearing of the canal line of timber for some 20 miles.

(9) The completion of surveys for location and of plans for construction of the railroad system, and the construction and equipment of 11 miles of this line.

(10) The acquisition by purchase of the most valuable and powerful dredging plant to be found in America under one management.

(11) The fitting up and operation of this plant and the opening of over a mile of the canal.

(12) The acquirement by purchase of the valuable and exclusive franchise for the steam navigation of the San Juan River and Lake, together with the extensive plant of the navigation company, consisting of offices, lands, steamboats, tugs, lighters, repair shops, etc.

(13) And lastly, what is felt to be the most important result of all is the demonstration, secured by experience, of the salubrity of the climate, the efficiency of labor, and the sufficiency of the estimates of the chief engineer for the harbor and canal dredging and railroad work.

The Government of Nicaragua, by a communication dated November 8, 1890, has officially recognized and declared that the company has more than complied with the provisions of article 47 of the concession, requiring the expenditure of $2,000,000 during the first year of the work. This formal acknowledgment confirms the company's title to the concessionary rights for a term of ten years in which to complete the canal.

A detailed description of the proposed canal and the work to be accomplished in its construction, together with the maps showing the route thereof as the same has been finally located, was annexed to the annual report of the company for the year 1890, to which reference is hereby made for said particulars.

In witness whereof the Maritime Canal Company of Nicaragua has caused its corporate seal to be hereunto affixed and these presents to be signed by its president and secretary, this 3d day of December, A. D. 1892.

THE MARITIME CANAL COMPANY OF NICARAGUA,
By HIRAM HITCHCOCK,
President.
[SEAL.]
THOS. B. ATKINS,
Secretary.

STATE OF NEW YORK, *city and county of New York, ss:*

Hiram Hitchcock, being duly sworn, says: That he is the president of the said The Maritime Canal Company of Nicaragua; that he has read the foregoing annual report and knows the contents thereof, and that the same is in all respects correct and true.

HIRAM HITCHCOCK.

Sworn to before me this 3d day of December, 1892.
[SEAL.]
V. BIGELOW,
Notary Public, New York County.

STATE OF NEW YORK, *city and county of New York, ss:*

Thomas B. Atkins, being duly sworn, says: That he is the secretary of the said The Maritime Canal Company of Nicaragua; that he has read the foregoing annual report and knows the contents thereof, and that the same is in all respects correct and true.

THOS. B. ATKINS.

Sworn to before me this 3d day of December, 1892.
[SEAL.]
V. BIGELOW,
Notary Public, New York County

STATE OF NEW YORK, *City and County of New York, ss:*

On the 3d day of December, 1892, before me personally came Thomas B. Atkins, known to me to be the secretary of The Maritime Canal Company of Nicaragua, and with whom I am personally acquainted, who, being by me duly sworn, did depose and say: That he resided in the city of New York; that he was the secretary of the Maritime Canal Company of Nicaragua; that he knew the corporate seal of said company; that the seal affixed to the foregoing report was such corporate seal; that it was so affixed by the order of the board of directors of said company, and that he signed his name thereto by the like order as secretary of the said company.

And the said Thomas B. Atkins further said that he was acquainted with Hiram Hitchcock and knew him to be the president of said company; that the signature of the said Hiram Hitchcock subscribed to the said instrument was in the genuine handwriting of the said Hiram Hitchcock and was thereto subscribed by the like order of the said board of directors and in the presence of him, the said Thomas B. Atkins.

In witness whereof I have hereunto set my hand and official seal this 3d day of December, A. D. 1892.

[SEAL.]
V. BIGELOW,
Notary Public, New York County.

EXHIBIT 2.

[Senate Ex. Doc. No. 5, Fifty-third Congress, second session.]

LETTER FROM THE SECRETARY OF THE INTERIOR, FORWARDING REPORT OF MARITIME CANAL COMPANY OF NICARAGUA.

DEPARTMENT OF THE INTERIOR,
Washington, December 5, 1893.

SIR: I have the honor to transmit herewith, for the information of the Senate, the original report of the Maritime Canal Company of Nicaragua, submitted to this Department this day, in compliance with the requirements of section 6 of the act of Congress approved February 20, 1889, entitled, "An act to incorporate the Maritime Canal Company of Nicaragua."

Very respectfully,

HOKE SMITH,
Secretary.

The PRESIDENT OF THE SENATE.

New York, *December —, 1893.*

Sir: Pursuant to section 6 of the act entitled "An act to incorporate The Maritime Canal Company of Nicaragua," approved February 20, 1889, which provides that said company shall make a report on the first Monday of December in each year to the Secretary of the Interior, and in accordance with instructions prescribing the form of such report and the particulars to be given therein, the said Maritime Canal Company of Nicaragua reports as follows:

First. That the regular annual meeting of the company was held at No. 44 Wall street, in the city of New York, on the 4th day of May, 1893, pursuant to the provisions of the by-laws, and that at such meeting Messrs. Joseph Bryan, James Roosevelt, Hiram Hitchcock, Thomas B. Atkins, and Horacio Guzman were duly elected directors of said company to fill the places made vacant by the class whose term of office expired on the said 4th day of May, 1893, and to serve for the period of three years as provided for in the said act of incorporation, and that at the same time Mr. Robert Sturgis was elected as director to fill a vacancy existing in the class of 1895, and Mr. Samuel Barton was elected as director to fill a vacancy in the class of 1894. Mr. Barton failed to qualify and Mr. F. F. Thompson was subsequently elected to fill the vacancy in the class of 1894. Since then Mr. A. B. Darling and Mr. Alexander T. Mason of the class of 1894 have resigned and the vacancies caused by their resignations have not yet been filled.

Second. That the board of directors of said company as now constituted is composed of the following stockholders:

Class of 1894.—Franklin Fairbanks, C. Ridgeley Goodwin, and F. F. Thompson.

Class of 1895.—Charles P. Daley, Daniel Ammen, Horace L. Hotchkiss, Henry E. Howland, and Robert Sturgis.

Class of 1896.—Joseph Bryan, James Roosevelt, Hiram Hitchcock, Thomas B. Atkins, and Horacio Guzman (Nicaraguan director).

A majority of the above-named directors are citizens and residents of the United States.

Third. That at the first meeting of the board of directors held after the said annual election the following officers were duly elected to serve for the ensuing year, to wit: President, Hiram Hitchcock; vice-president, Charles P. Daly; secretary and treasurer, Thomas B. Atkins. All of the officers so elected are citizens and residents of the United States. That at said meeting the following directors were elected members of the executive committee, as provided for in the by-laws of said company, to wit: James Roosevelt, chairman; Hiram Hitchcock, Horace L. Hotchkiss, Henry E. Howland, and Alexander T. Mason.

Fourth. That since the organization of the Maritime Canal Company of Nicaragua 10,145 shares of the capital stock of said company have been subscribed for at par, amounting in the aggregate to the sum of $1,014,500, of which amount $1,006,940 has been paid into the treasury in cash; that there has been paid into the treasury from other sources $48,871.62, making the total amount of cash received $1,055,811.62.

Fifth. That since the organization of the company it has paid for property, work, and labor done, and materials furnished in the execution of the work of constructing the canal and in administration expenses, the sum of $830,778.67 in cash and 31,990 shares of the full-paid capital stock of the company of the par value of $3,199,000, and is obligated for $6,855,000 of its first-mortgage bonds. It has also issued 180,000 shares of its capital stock of the par value of $18,000,000 in payment for concessionary rights, privileges, franchises, and other property.

Sixth. That the liabilities of the company consist of the amounts still due under the concessions granted to the company; of the $6,855,000 of bonds before mentioned, the said bonds being due to the Nicaragua Canal Construction Company for work and labor done and materials furnished in the execution of the work of constructing the Interoceanic Canal, and of cash liabilities outstanding and unpaid to an amount not exceeding $50,000.

Seventh. The assets of the company consist of its capital stock, of the concessions, rights, privileges, and franchises which it now owns, and of the plant, equipments, materials, lands, buildings, structures, railways, steamboats, telephone and telegraph lines, dredges, locomotives, cars, machinery, stores, machine shops, supplies, and other property in Central America, including the lands situated between the lake and the Pacific, purchased from the Government of Nicaragua for the route of the canal, at a cost of $50,000, in accordance with the provisions of the Nicaraguan concession.

In our annual report for 1892 we submitted a statement of the work that had been accomplished up to that date; since then the unprecedented conditions of the money market have been the cause of serious embarrassment to all enterprises that depended upon the sale of securities for means to prosecute their undertakings. The Nicaragua Canal Construction Company, under contract with this company for the construction of the canal, suffered under the general conditions in common with others, and was obliged first to limit its expenditures to what was requisite for protection and preservation of its plant, and finally to suspend all payments. This resulted in the appointment, on August 30, 1893, by the circuit court for the United States for the southern district of New York, of a receiver for that company. The secretary and treasurer of that company was appointed such receiver.

The result of this condition of affairs is that no material advancement in construction work has been accomplished since the report made by the company to the Department in December, 1892, and, therefore, we beg to refer to that report as showing substantially the present condition of the work.

Upon the appointment of the receiver measures were inaugurated by shareholders of the construction company for the reorganization of that company upon a strong financial basis, providing for the liquidation of its indebtedness and the active prosecution of work under its contract, in the immediate future. These measures are now well under way with the every assurance of a successful issue, and the Maritime Canal Company is awaiting the result.

In witness whereof the Maritime Canal Company of Nicaragua has caused its corporate seal to be hereunto affixed and these presents to be signed by its president and secretary this 4th day of December, A. D. 1893.

THE MARITIME CANAL COMPANY OF NICARAGUA.
By HIRAM HITCHCOCK,
President.

[SEAL.]
THOS. B. ATKINS,
Secretary.

The SECRETARY OF THE INTERIOR,
Washington, D. C.

STATE OF NEW YORK, *City and County of New York, ss:*

Hiram Hitchcock, being duly sworn, says that he is the president of the said The Maritime Canal Company of Nicaragua; that he has read the foregoing annual report and knows the contents thereof, and that the same is in all respects correct and true.

HIRAM HITCHCOCK.

Sworn to before me this 4th day of December, 1893.
[SEAL.]
V. BIGELOW,
Notary Public, New York County.

STATE OF NEW YORK, *City and County of New York, ss:*

Thomas B. Atkins, being duly sworn, says, that he is the secretary of the said The Maritime Canal Company, of Nicaragua; that he has read the foregoing annual report and knows the contents thereof, and that the same is in all respects correct and true.

THOS. B. ATKINS.

Sworn to before me this 4th day of December, 1893.
[SEAL.]
V. BIGELOW,
Notary Public, New York County.

STATE OF NEW YORK, *City and County of New York, ss:*

On the 4th day of December, in the year 1893, before me personally came Thomas B. Atkins, known to me to be the secretary of the Maritime Canal Company, of Nicaragua, and with whom I am personally acquainted, who, being by me duly sworn, did depose and say, that he resided in Roselle, N. J.; that he was the secretary of the Maritime Canal Company, of Nicaragua; that he knew the corporate seal of said company; that the seal affixed to the foregoing report was such corporate seal; that it was so affixed by the order of the board of directors of said company, and that he signed his name thereto by the like order as secretary of the said company.

And the said Thomas B. Atkins further said that he was acquainted with Hiram Hitchcock and knew him to be the president of said company; that the signature of the said Hiram Hitchcock subscribed to the said instrument was in the genuine handwriting of the said Hiram Hitchcock, and was thereto subscribed by the like order of the said board of directors and in the presence of him, the said Thomas B. Atkins.

In witness whereof I have hereunto set my hand and official seal this 4th day of December, A. D. 1893.

[SEAL.]
V. BIGELOW,
Notary Public, New York County.

EXHIBIT 3.

It has been commonly said that the attractive influence of the Nicaragua Canal will be felt as far as the meridian 110° east from Greenwich. There can be very little doubt as to the general correctness of this opinion; there is room for question whether it will not be felt even beyond that limit.

Owing to favoring winds and currents which prevail in the Pacific it is no unusual thing for English sailing vessels which make the outward voyage to Hongkong or

Australia by the way of Good Hope to return around Cape Horn. Sailing vessels can only avail themselves of the shortened distance of the Suez route by towage through the entire length of the Red Sea, as well as through the canal, a total distance of 1,310 miles; whereas the entire length of the Nicaragua Canal is but 169½ miles through, which distance the cost of towage would not be a prohibitive expense, and the shortened distance, together with favoring winds and currents already availed of, in return voyages as but just mentioned, would extend the influence of the canal as regards return voyages even beyond the dividing meridian.

One hundred and ten degrees east from Greenwich includes, so far as the United States is concerned, the entire coast of China with the ports of Macao, Hongkong, Shanghai, and the island of Formosa, the Kingdom of Corea, the Empire of Japan, the Philippine Islands, Borneo, New Guinea, Australia, Tasmania, New Zealand, and, in fact, almost all of the islands of the Pacific. These points, together with the entire inhabited portion of the Pacific coast of the American Continent, are brought nearer to the eastern ports of the United States by distances varying from 3,000 to 10,000 miles. But what is of still greater importance is that all of them are brought nearly the whole width of the Atlantic Ocean nearer to New York than to European ports. New York and Liverpool are now practically equidistant from Valparaiso, Callao, Acapulco, San Francisco, and all intermediate ports, but with the opening of the canal New York will be brought 2,700 miles nearer these ports than Liverpool. At the same time Valparaiso, on the Pacific coast of South America, is brought 1,000 miles nearer to Liverpool and other European ports than by existing routes, and points north of Valparaiso are approximated by distances varying from 1,000 to 6,000 miles.

In view of these conditions it is not unreasonable to claim that all commerce existing within the limit designated will be subject to the attractive influence of a canal across the American isthmus, although there may be differences of opinion as to the degree to which that attraction will be felt.

In the years 1889 and 1890, according to the latest accessible returns, principally taken from the Statistician's Year Book and the United States Reports on Commerce and Navigation published in 1891, there was transacted between the points severally named in the following tables commerce to the amount of the value indicated:

TABLE A.—*Traffic entirely tributary to the canal.*

Between—	
Great Britain and United States Pacific ports	$31, 229, 063
France and United States Pacific ports	2, 276, 049
Germany and United States Pacific ports	1, 287, 129
Belgium and United States Pacific ports	1, 450, 168
Italy and United States Pacific ports	232, 290
Cuba and United States Pacific ports	587, 794
Brazil and United States Pacific ports	513, 077
Great Britain and Ecuador	1, 693, 030
Great Britain and Peru	11, 260, 380
Great Britain and Chile	65, 390, 571
France and Chile	7, 857, 426
Germany and Chile	14, 098, 930
Belgium and Peru	7, 031, 400
Belgium and Chile	433, 500
Belgium and China	304, 900
Rest of Europe and western coast of South America	5, 000, 000
Europe and Pacific ports of Mexico (Acapulco, Manzanillo, San Blas, Mazatlan)	5, 000, 000
Great Britain and Japan	33, 732, 534
Germany and Japan	6, 526, 283
Holland and Belgium	1, 550, 420
Great Britain and New Zealand	53, 429, 965
United States (Atlantic ports) and Japan	13, 796, 115
United States (Atlantic ports) and Hongkong	2, 303, 982
United States (Atlantic ports) and China	14, 164, 632
United States (Atlantic ports) and New Zealand	3, 419, 000
United States (Atlantic ports) and Australia	11, 472, 003
United States (Atlantic ports) and Philippine Islands	10, 101, 362
United States (Atlantic ports) and Hawaiian Islands	469, 500
United States (Atlantic ports) and Chile	5, 789, 411
United States (Atlantic ports) and Peru	1, 573, 530
United States (Atlantic ports) and Ecuador	1, 063, 721
	315, 038, 165

To this aggregate must be added: For existing traffic between Pacific ports of the United States and British Columbia with Atlantic ports, value not returned, estimated at 250,000 tons. For canned and dried fruits, wines, canned salmon, shingles, hops, wool, etc., transported by the railroads in 1890 to the amount of over 250,000 tons.

All of the foregoing is traffic which, because of the manifest advantage to it in the saving of distance or cost, or both, must certainly make use of the canal. It has been questioned whether all of the business of the Pacific coast of South America will find it advantageous to use the canal, inasmuch as the saving of distance at Valparaiso for steamers which pass through the Strait of Magellan is but little more than 1,000 miles; this, however, is not a fair statement of facts. Nine-tenths of the business is transacted by the Pacific Steam Navigation Company, which run their vessels from Liverpool to Callao, stopping at Valparaiso and other ports en route. The distance via the Strait of Magellan from Liverpool to Callao, which is the actual length of the voyage, is about 9,960 miles. The distance, making the voyage in the opposite direction via the Nicaragua Canal, would be 7,734 miles to Valparaiso, without reference to calling at the intermediate ports, which would be about the same in either direction, or a saving of at least 2,226 miles on the voyage. For sailing vessels which can not avail themselves of the shorter route by "the Straits," but must double Cape Horn on their passage, Valparaiso, without regard to Callao, will be within the zone of canal attraction. For this reason the entire amount of this commerce is included in Table A.

TABLE B.—Traffic within the zone of the canal's attraction, but not entirely tributary to it:

Between Central America and all countries:		
Guatemala, exclusive of specie	$17,418,737	
Salvador, exclusive of specie	8,559,836	
Nicaragua, exclusive of specie	5,644,408	
Costa Rica, exclusive of specie	10,029,283	
		$41,652,264
Between Hongkong and Great Britain		16,500,000
Between China and Great Britain		55,272,430
Between China, Germany, France, etc		22,700,469
Between Australia and Great Britain:		
New South Wales	88,505,150	
Queensland	21,258,125	
South Australia	24,250,570	
Victoria	82,256,300	
West Australia	3,712,100	
		219,982,245
Between—		
Australia and Belgium		3,543,470
Australia and Germany		14,651,250
Australia and Switzerland		842,812
Australia and Sweden and Norway		2,560,825
Tasmania and Great Britain		4,051,610
Philippine Islands		19,372,075
Japan and France		17,592,895
New Caledonia, Tahiti, etc., and France		1,565,812
Between Pacific ports of the United States and—		
Hongkong	3,238,087	
China	5,033,735	
Japan	12,540,938	
Australia	3,973,754	
Philippine Islands	1,613,451	
Hawaiian Islands	16,555,725	
		42,955,690
Total		463,243,847

(For analysis and distribution of these tables *see* pp. 9, 10, and 11.)

In addition to the commerce included in these tables, there is a large business between Great Britain and the straits settlement and between Holland and Great Britain and the Dutch East Indies, in which the United States does not now participate, except to a very limited extent through the Pacific ports, or as purchaser in the markets of England and Holland. With the development of commerce between the United States and the coasts of Asia and the Pacific islands consequent upon the opening of the canal, it will naturally follow that this business, lying so near to the dividing line, although actually beyond it, shall, to some extent, contribute to the aggregate of the canal traffic, as being within advantageous reach of voyages from Atlantic ports of the United States undertaken originally perhaps to other adjacent points, but extended to embrace this business incidentally.

To determine the "tonnage equivalent" of the commerce, which enters into the foregoing tables in the form of values only, the only form in which the information is accessible in the aggregate, other statistical information furnishes valuable data.

A considerable portion of the aggregate is in low price commodities carried in large bulk; as the wheat of California and Chile and the nitrates and guano of Chile, shipped to Europe, and the coal oil of the United States shipped to Japan, China, and other points of destination. The value and bulk of these commodities is definitely reported, and thus removed from the field of estimate. For the remainder, a careful consideration of other well-established statistics will afford a satisfactory unit of valuation, or an average value per ton, by which may be determined the bulk represented by so many millions of dollars of value. This method is made necessary by the fact that the shipping returns of tonnage entered and cleared are frequently misleading. In the South American States, the same vessel is often registered in more than one port of the same country, and is thus made to count twice or more in the tonnage reports. The only traffic data of those countries, of reliability, are the values of exports and imports, which, from the channel through which they are collected—customs returns—are not apt, at all events, to be exaggerated.

The total foreign commerce of the United States for the year ending June 30, 1890, is reported as follows (merchandise only):

	Tons.	Value.
Entered, cargo only	14, 111, 944	$789, 310, 409
Cleared, cargo only	15, 930, 385	845, 293, 828
Total	30, 042, 329	1, 634, 604, 337

Average value of 1 ton, $54.41.

Statistics for Great Britain, France, and Germany are as yet complete and accessible only for the year 1889. In that year the commerce of Great Britain and other countries was as follows:

	Tons.	Value.
Entered, cargo only	28, 517, 000	£427, 595, 442
Cleared, cargo only	33, 048, 000	313, 874, 970
Total	61, 565, 000	741, 470, 412

Average value of 1 ton, £12 10*d*=$58.76.

The commerce of France with foreign countries for 1889, by sea, was as follows:

	Tons.	Value.
		Francs.
Entered, cargo only	12, 835, 849	3, 670, 000, 000
Cleared, cargo only	9, 397, 239	3, 246, 000, 000
Total	22, 233, 088	6, 916, 000, 000

Average value of 1 ton, 310 francs = $59.52.

Of Germany, the only statistics available for use are those of the port of Hamburg, which is the principal port of entry of the German Empire. They are as follows:

	Tons.	Value.
		Marks.
Entered, cargo only	4, 469, 698	1, 245, 581, 000
Cleared, cargo only	3, 496, 303	1, 206, 415, 000
Total	7, 966, 001	2, 451, 996, 000

Average value of 1 ton, 307 marks = $73.33.

We have thus the commerce—

	Tons.	Per ton.
Of Great Britain	61,565,000	$58.76
Of France	22,233,088	59.52
Of Hamburg	7,966.001	73.33
Of United States	30,042,329	54.48

Making a total of 121,806,415 tons of merchandise, at $58.84 per ton, as its average value.

It is to be borne in mind that these returns are of registered tonnage, and the unit value thus established is for "registered," not actual tons.

In 1890 the wheat and flour fleet from San Francisco carried 780,000 tons of wheat and flour, at a valuation of $21,250,000, to Europe. Chile sent 860,000 tons of nitrates, at a valuation of $27,290,410, and 75,000 tons of wheat, at a valuation of $2,111,412. Peru sent about 75,000 tons of nitrate and 6,000 tons of guano, at a valuation of $350,000. Deducting this tonnage at its valuation, viz, 1,796,000 tons, at a value of $51,011,822, from the total tonnage and valuation of European commerce, viz, 91,764,089 tons, valued at $5,531,784,255, the average tonnage value of the remainder is $60.90.

In the year 1890 the United States exported coal oil, crude and refined, to the value of $47,147,163, over 3,300,000 tons in bulk. Deducting this and the tonnage and value of the wheat exports of California from the total tonnage and value of the commerce of the United States, the average value of the remainder is $62.23, or again adding together the value and tonnage of the coal oil traffic and the value and bulk of the wheat, nitrates, etc., as previously given, and deducting the totals this time from the total tonnage and valuation of the commerce of the four great maritime nations, $7,166,388,592 and tons 121,806,415, the average value of the remainder is $60.54 per ton.

From the foregoing, it appears just to assume $62 per ton as a unit of value certainly not too low wherewith to transmute the values of ordinary commerce, the bulk of which is unknown, over and above that which is known, into correspondent tonnage quantities.

Of the exportation of coal oil from the United States, 714,150 tons of illuminating oil, at a valuation of $13,974,134 was shipped to foreign ports on the Pacific in addition to large quantities shipped to San Francisco, San Diego, Portland, and other home ports. Seven million four hundred and seventy-two thousand nine hundred and sixty gallons, or about 37,000 tons were shipped to San Francisco alone.

Of the large aggregate shipped to foreign ports, the principal portion was transported by sailing vessels around one or the other of the capes, as such craft could not avail themselves of the shorter route by Suez, for the reasons before given; but as sailing vessels will be able to make use of the Nicaragua Canal, this entire business with its increase, will naturally take that route. Three hundred and eighty-two thousand six hundred and ten tons of it at a valuation of $7,745,740 was carried between ports included in Table A; 95,000 tons at a valuation of $1,837,481 between ports in Table B, and 236,540 tons, valued at $4,390,913 was distributed between British and French East Indies and Oceanica.

The aggregate of the commerce included in Table A amounts to $315,038,165. Of this total $21,250,000 represents shipments of wheat from San Francisco to Europe, 780,000 tons; $27,290,410 shipments of nitrates from Chile, 860,000 tons; $2,111,412 shipments of wheat from Chile, 75,000 tons; $350,000 shipments of nitrates and guano from Peru, 81,000; 7,745,000 shipments of coal oil from United States to ports in Table A, $382,610 tons; $256,291,343, the remainder of Table A, represents general traffic between ports indicated. Taken at the average value of $62 per ton it is equivalent to 4,133,730 tons.

For existing traffic around Cape Horn and via Isthmus of Panama between ports of the United States and with British Columbia, estimated at 250,000 tons.

For transcontinental railroad traffic in 1890 California exported from the port of San Francisco 148,446,150 pounds of canned and dried fruits, including raisins; 1,623,867 cases of canned salmon; 4,500,000 gallons of wines and brandy; 5,734,120 pounds of hops, and 22,662,000 pounds of wool, fully 90 per cent of which was transported by sail across the continent. Portland, Seattle, Tacoma, and other cities were also large exporters of like commodities; quantities of shingles were shipped from Puget Sound and all the places named were large importers of provisions by railroad. At a moderate estimate this business amounted to 250,000 tons; total, 6,812,340 tons.

The commerce included in Table B, amounting in the aggregate to $463,243,847, *while within* the zone of the canal's influence, will be attracted by it only in part.

The value of coal oil shipped to Central America and the East Indies, Dutch, French, and British, etc., amounts to $6,228,394, equivalent to (may be regarded as entirely tributary) 331,540 tons.

(The proportion taken by Central America is small, and therefore need not be separated in the general estimate.)

The total commerce of the four States of Central America which have their principal ports on the Pacific amounts to $41,652,264. As coffee constitutes the principal commodity of *export*, it is conceded that the average tonnage value is increased. One hundred dollars is therefore assumed as the unit of value in this case, at which rate the valuation is equivalent to 416,652 tons. A small portion of this business is transacted by the gulf ports; for this reason 60 per cent only is estimated as tributary to the canal, say, 250,000 tons.

The commerce of Hongkong, Shanghai, Japan, Australia, Tasmania, the Philippines, and other islands of the Pacific with Europe amounts to $378,635,893. As high-priced commodities also enter largely into this trade, we assume the same unit of value per ton as for Central America, say, $100; the equivalent tonnage is 3,786,359 tons. A very large proportion of this trade is now carried in sailing vessels which make their outward voyage by way of Cape of Good Hope and because of the favoring winds and currents return home by the longer route around Cape Horn.

Conceding that one-half of this total traffic (the outward bound) will not be affected, it is fair to consider 40 per cent of the remainder, or 20 per cent of the whole, as tributary, say, 757,272 tons.

The business between Pacific ports of the United States and Hongkong, China, Japan, Australia, etc., is also in high-priced commodities, and amounts to $42,955,690, which, taken at $100 per ton, is equivalent to 429,557 tons. It is largely local trade of the Pacific slope, but some of it is transshipped by rail to Eastern ports; the proportion tributary is estimated at one-eighth, say, 50,000 tons.

The shipments *from* the Straits Settlements and the Dutch East Indies to Great Britain and from the Dutch East Indies to Holland amount, in the aggregate, to a valuation of $95,472,688, or, at an average per ton of $100, to an equivalent of 954,727 tons. It is not included in Table B, being more remote and likely to yield but a small proportion, say, 10 per cent only, 95,473 tons. The aggregate of these estimates amounts to 8,296,625 tons.

This total may be regarded as the tonnage now existing, which if transit by the canal were possible to-day, would naturally seek that route and pay its tolls in preference to following routes which are at present in use.

Statistics show the normal growth of commerce to be at the ratio of about 1 per cent per annum. Assuming that the canal will be completed and ready for use by the year 1897, and that the statistics which we have used are for the year 1890, we may add 7 per cent for natural growth, say 580,760 tons, making in round numbers 8,900,000 tons as the aggregate of the existing freight for which the canal at its opening will afford the most convenient route for transportation; but this is only allowing for a normal growth of commerce, but for manifest reasons growth in greater proportion than usual is to be expected whenever the near prospect of the canal's completion shall give such assurance of its availability as to induce immigration and warrant merchants in venturing upon new enterprises. Moreover, with the opening of the canal not only will a new route be provided, but new fields will be opened to commerce by the more advantageous provision for transport of the commodities of commerce, as was argued in the pamphlet on prospective traffic, published in 1890. In that pamphlet it was remarked:

"The products of Alaska, as well as of Washington and Oregon, mostly low-priced commodities furnishing a large bulk of tonnage, will be carried at less cost to Eastern markets, the markets of the Western coast of South America will be opened to the low-priced coals of the Southwestern States, and the coasting trade now carried on with the West Indies to the extent of over 500,000 tons per annum will be multiplied beyond calculation. If a traffic of 500,000 tons has been developed between the United States and the Islands of the Carribean Sea, what may be expected when the markets of the Pacific coast of Columbia, Mexico, and Central America, of the States of Ecuador, Peru, Bolivia, Chile, and of southern California are opened to the easy access of coasting vessels?

"In the existing lake and coastwise trade of the United States steel barges carrying from 1,500 to 3,000 tons freight, transported by powerful tugs, are taken at low cost to market points, and there left to discharge and reload for a return voyage, while their motive power returns without delay with freights, in similar barges, made ready for departure before its arrival. Thus movement of freight is accelerated, invested capital is made to yield its largest returns, shippers profit by the possibility of lowered rates and consumers by the possibility of lowered prices. Under such methods the traffic of the Sault Ste. Marie Canal has developed from 1,567,741 tons in 1881 to the enormous aggregate of 8,388,891 tons in 1891, and is still increasing. And this traffic has grown up in connection with the internal trade only of a portion of the Northwestern States with the East. Like results will follow similar methods, which are equally available in the waters opened up by the Nicaragua Canal, and American enterprise will not be slow to avail itself of the unprecedented opportunity. What people have ever had such an opportunity put before them?"

We have already mentioned the products of the forests and fisheries of Oregon, Washington, and Alaska, and the products of British Columbia. Returning to the subject, the following facts will be of interest:

The salmon pack of British Columbia, Alaska, Washington, Oregon, and California amounted in 1889 to 1,683,800 cases, about 84,200 tons, valued at $9,064,000, exceeding in quantity the pack of 1888 by 527,000 cases; 680,000 cases of the product was from Alaska and 422,000 from British Columbia. This is a growing industry. The pack amounted in 1880 to only 679,490 cases; in ten years it has increased nearly 250 per cent; by 1897, at the same ratio of increase, it will amount to nearly 3,500,000 cases. Hop-growing as an industry was commenced in Oregon and Washington in 1865. In 1889 the product was 70,000 bales, regularly quoted and competing with other goods in the New York market. The fur-seal and whale fisheries are also growing and important industries.

The cultivation of India rubber as an industry in Central America and on the western coast of California is already attracting attention. The increasing demand for the gum and the destruction of trees in their natural state by the reckless huleros, or native gum-gatherers, makes attention to an artificial supply for future demands of manufacture imperative. Already large manufacturing corporations in this country are making plantations to meet it. The huleros are so careless that not only are they destructive of the trees, but much of the gum brought by them to market is in bad condition and commands only 26 cents per pound, whereas when properly collected it is worth as much as 80 cents for the best quality. The tree grows naturally in Central America and Mexico. The western coast of the last-named country and of southern California between the ocean and 1,800 to 2,000 feet of elevation above the level of the sea seems particularly favorable to its best development. A plantation is made with shoots gathered in the forests, and with proper care will be in condition to yield a crop in six or seven years. A tree in good condition yields 10 to 12 pounds per annum, and, if not maltreated, continues to yield year after year, apparently without limit. Its yield is worth, according to quality—which depends chiefly upon its treatment—from 50 cents to 80 cents per pound. This, too, is an industry which will pay tribute to the canal.

But in the forests of the northwestern Pacific coast there already exists material which needs only the facilities of the canal for its transportation to a favorable market to yield a tonnage which alone will probably exceed that of all other industries combined. The wonderful growth of the lumber trade of that section under present limitations of transportation is an indication of the magnitude to which it will grow with the opening of new and more extended markets by the shortening of distances to them on lines within the still waters of the Temperate and Torrid zones instead of by the routes now existing through the tempestuous seas of the storm zone.

In 1886 the shipment of lumber from Oregon amounted to 6,000,000 feet, equal to 12,500 tons; in 1887, to 48,000,000 feet, equal to 100,000 tons. In 1888 the amount cut amounted to 706,985,000 feet, and the shipments abroad to 471,325,000 feet, equal to 981,925 tons, or nearly 1,000,000 tons.

Concerning the lumber trade with Eastern markets, the Post-Intelligencer, of Seattle, Wash., published the following under the dates indicated:

"*July 11.*—The sound sawmills (Puget Sound) have lately been filling special Eastern and Southern orders for extra length stuff. Quite a large number of huge spars have been lately shipped from sound ports to the East where there is ever an active market sale for that material.

"*July 14.*—The Puget Sound cedar shingles were first entered in the Eastern markets five years ago. The demand for them has ever since steadily increased, and now shingle mills all over the sound are shipping their products East as far as Ohio (i. e. railroad routes)."

The forests of Maine no longer yield the timber needed for masts and spars of large vessels. In the forests of Oregon trees grow to 12 feet in diameter and 300 feet in height. The average length of a cargo of sticks taken to Boston from Puget Sound by the bark *Crapo*, in 1890, was 126 feet, and their average diameter 39 inches. Sixty of these sticks were bought by a shipbuilder of Bath, Me., and were made into a raft and towed around to his yard. This fact shows how depleted the Maine forests are of spar timber. Cuba has attempted the importation of lumber for building purposes around Cape Horn, but found the experiment too costly to be continued. In our Southern States their own hard pine, though less desirable, is taking the place of soft pine because of advancing prices. All these demands will be met and supplied from the Oregon and Washington lumber fields with the opening of the canal. What this demand and supply will actually amount to is mere conjecture, but considering the coastwise trade as a whole, including the mahogany, rosewood, ironwood, and teak of Southern Pacific coasts, the growing trade of Central America in coffee, cocoa, india rubber, mahogany, and other hard woods, the furs of Alaska, and the seal fisheries, whale oil, wheat, canned salmon, and other products of British Columbia, Washington, and Oregon, spar timber, and other lumber from the forests, and our outbound trade in coal, textile fabrics, agricultural implements, machinery, iron goods, etc., an addition of 1,000,000 tons per annum will be conceded to be none too great an allowance.

The aggregate of the traffic, apparent at present, from which the canal may be expected to derive its business and its revenue, amounts, then, to 8,900,000 tons, to which may be added at least 1,000,000 tons for the traffic mentioned on foregoing pages, not to speak of those unforeseen and unexpected developments, of which the commerce of all new countries has always been prolific, whenever increased facilities have afforded more favorable opportunity for an exploitation of the natural resources of the region. In this respect the opportunity of the Nicaragua Canal is unique. The countries chiefly brought into nearer contact by the Suez Canal are old and densely populated. Europe with its population of 101 to the square mile, and Asia, with a population of 57 to the mile, or, to speak more precisely, England, France, and Belgium as parts of Europe, and India and China as parts of Asia, have very few new or untried resources yet remaining open for development. On the other hand, by the Nicaragua Canal, North America with a population of 14 to the mile, chiefly east of the Rocky Mountains; South America with a population of 5 to the mile, and Australia with a population of only 1.4 to the mile, all of them the abodes of vigorous, rapidly increasing, and enterprising populations, with as yet many only partially developed resources, the magnitude and value of which are already shown by such essays as have been possible under existing circumstances to be almost incalculable, are brought nearer to each other and into closer connection with Europe, by a channel of communication through a country unsurpassed in its natural beauties and resources, possessing a climate exceptionally healthy, which from its natural characteristics must, when facilities for travel are afforded, become a pleasure resort for travelers from all parts of the world.

It would seem that if the conditions for an unprecedented growth of population, commerce, and material prosperity ever existed anywhere, they exist here to a degree never before exceeded. The great success of the canal at Suez, not only in respect of its returns to those who ventured their capital in its construction, but more especially in the realization of all the advantages to commerce which were predicted of it by its projectors, is an assurance that the Nicaragua Canal, when completed, will find commerce ready to avail itself, at once, of its advantages, instead of waiting until the more venturesome spirits shall have tried them and proved their merits. Because of the great success at Suez, the advantages of canal transit have ceased to be subject of experiment, and have become demonstrated facts. The business of the Nicaragua Canal, therefore, will not be of small beginnings and slow growth, but will at once assume a magnitude commensurate with the opportunity; and it is not unreasonable to expect that of the 9,900,000 tons estimated as within the zone of attraction, at least two-thirds, or, say, 6,500,000 tons, will seek the new route for transit as early as within the second year of its operation.

If the canal tolls be fixed at $2.50 per ton this amount of traffic will yield a gross revenue of $16,250,000.

The cost of maintenance and operation of the canal after its completion can not be large. The route is made up principally of broad stretches of water, with natural banks, or of cuttings through solid rock, which, once made, will be permanent; and there are no sands drifting from widespread desert plains, as at Suez, to fill its channel continually and make necessary large and unceasing expense for heavy dredging. The cost of maintenance must, from the nature of things, therefore, be moderate. The operation of the lock of the Sault Ste. Marie Canal, which passed nearly 7,500,000 tons in the season of 1890-'91, together with all other expenses of that canal for that year, amounted to $45,417. Allowing $50,000 for each of the 6 locks of the Nicaragua Canal for operating alone, and making a similarly liberal allowance for maintenance, administration, and all other expenses, the total annual cost can not exceed $1,500,000, which, on an annual traffic of 6,500,000 tons, at the rate of toll suggested, shows a net revenue of $14,750,000, or 5 per cent on a total capitalization of $295,000,000 to be realized immediately upon the attainment by the enterprise of such a condition of advancement as will afford opportunity for demonstration of its capabilities.

What the growth of its traffic and revenue may be from this point is, of course, a matter of conjecture, but in view of all the contingent conditions it can not fail to be large and rapid, and it is not unreasonable to believe that although the canal has been projected with a view to the accommodation of a large traffic, its capacity, before many years shall have passed, will be taxed to the utmost.

52D CONGRESS, } SENATE. { REPORT
2d Session. } { No.1142.

IN THE SENATE OF THE UNITED STATES.

DECEMBER 22, 1892.—Ordered to be printed.

Mr. SHERMAN, from the Committee on Foreign Relations, submitted the following

REPORT:

[To accompany S. 1218.]

On further consideration of the subject presented in their report of the Fifty-first Congress, the Committee on Foreign Relations recommend some changes in the details of the measure thus submitted to the Senate as a bill of the committee, but they adhere to and recommend the purposes and the general plan of legislation thus presented, and adopt the report then made in support and explanation of the Senate bill, No. 1218, now reported to the Senate with amendments.

With the progress of events relating to a ship canal through the Isthmus of Darien and, especially, with reference to the recent demonstration that the Panama Canal can no longer be looked to as furnishing the waterway that our communication between the Pacific States and the Atlantic States require as a commercial necessity and national protection, it is manifest that the people of the United States, without division on political lines, or on lines of latitude or longitude, are earnestly demanding that Government aid be extended to the Nicaragua Canal.

It is entirely clear that a work of such magnitude can not be constructed on the credit of any chartered company, at a reasonable cost, nor can this canal be so constructed as to guarantee its impartial use to all maritime nations without the assistance and support of the United States.

The concessions made by Nicaragua and Costa Rica under which this work is progressing distinctly provided that the canal should be constructed by a company of execution, to be called "The Maritime Canal Company of Nicaragua," with its principal office in New York. The concessionaires were all citizens of the United States, and, in conformity with their concession, they asked the United States for a charter, by act of Congress, to enable them to execute the work described in the concessions of Nicaragua and Costa Rica, which was granted by act of Congress, approved February 20, 1889.

This act of Congress, construed in connection with our treaties with Nicaragua and Great Britain, made this canal, in a practical and important sense, a facility of government in connection with our coastwise trade and our foreign commerce, and as to our postal establishment and the transmission of our troops and munitions of war and warships from ocean to ocean.

So that it was a clear and specific purpose of the act of Congress that the political control over the Maritime Canal Company of Nicaragua should be retained by the United States while that company should continue to act under that charter.

In this view, the act of Congress provides, in section 6, that—

> Said company shall make a report on the first Monday of December in each year, to the Secretary of the Interior, which shall be duly verified on oath by the president and secretary thereof, giving such detailed statement of its affairs, and of its assets and liabilities, as may be required by the Secretary of the Interior, and any willfully false statement so made shall be deemed perjury and punishable as such. And it shall be the duty of the Secretary of the Interior to require such annual statement and to prescribe the form thereof and the particulars to be given thereby.

No corporation, other than one created to promote public purposes, could be reasonably subjected to such requirements, and it is not possible, under a sound construction of the concessions granted by Costa Rica and Nicaragua, either as to their language or proposals, that those Republics could retain to themselves, respectively, in the body of their concessions, as Governments, the right to appoint directors in a mere private corporation.

Three Governments concurring in creating a corporation, in which each may have a special governmental interest or concern; in which each is or may be a stockholder, and entitled to appoint directors, and over whose conduct and destiny each Government exercises, to certain extent, a sovereign control, must by their joint or concurrent act create a public corporation.

The United States can, in the exercise of its sovereign power, expressly reserved in the charter, alter, amend, or repeal the act of Congress creating a corporation, in which Nicaragua has $6,000,000 of stock and a director, and Costa Rica has $1,500,000 of stock and a director, and can limit the entire stock of the company to $100,000,000. Neither of these Governments can, with due regard to its sovereignty, afford to consider this as a mere private corporation.

It is quite clear that these Governments admit the right of the United States, under the powers conferred in their concessions, to exercise this governmental control over the conduct and destiny of the Maritime Canal Company of Nicaragua, by participating in the organization of the company and in its control through directors appointed by them, and also by their respective decrees that the work done upon the canal, under the charter granted by the United States, is a full compliance with the conditions precedent upon which those concessions were to become permanent grants.

The committee have, therefore, considered the bill (S. 1218) as a measure relating to a public corporation, and that its provisions are in strict conformity with the concessions of Nicaragua and Costa Rica, owned by the Maritime Canal Company, and also with our treaties with all countries having an interest in the subject of this interoceanic canal.

The controlling facts relating to this work, in its engineering aspects, are stated in the former report of this committee, which is adopted as part of this report. They are not materially altered except in the direction of giving greater certainty that all the apparent doubts and difficulties then existing as to engineering problems are being removed, or minimized by the actual results of work done on the ground.

The work done on the canal in the clearing of timber from the line, in the building and ballasting the railroad through the marsh lands adjacent to the eastern coast, now 11½ miles long, and in deepening the entrance to the harbor at Greytown, has all fallen within the estimates submitted by Mr. Menocal as to its cost, and it does not, as yet, appear that his estimate of the total cost of the canal, viz: $65,000,000, *is likely to* be exceeded, when it is completed for traffic, if the money to build it is provided with certainty, so as not to increase the cost by unnecessary delays and expenditures.

The most recent report of the president and secretary of the Maritime Canal Company, made to the Secretary of the Interior, and the other documents and statements submitted on the hearings before this committee, authorized by the Senate, in the opinion of the committee justify the conclusions herein stated.

Under this bill, as amended by the committee, the liability of the United States upon the indorsement of the bonds of the Maritime Company is the same in amount as that contained in the former bill, viz, not to exceed $100,000,000, at the rate of 3 per cent interest per annum. The time of the maturity of the bonds is changed in the present bill. They are to bear date on the 1st day of January, 1893, and to bear interest from the date of actual issue and mature in 1953, and are redeemable at the pleasure of the Government after 1913.

The stock of the Maritime Company is limited to $100,000,000. Of this stock $6,000,000 is reserved to Nicaragua, as paid-up stock in its concession, $1,500,000 is reserved to Costa Rica in its concession, and $12,000,000 remains in the ownership of the purchasers thereof from the Maritime Canal Company of Nicaragua, it having been issued by that company in payment for the concessions and for all work done and expenditures made and engagements entered into prior to the date of the sale and transfer of the concessions to said company. All the remainder of the stock thus limited, viz, $80,500,000, is vested in the United States in absolute ownership and without liability to further payment or assessment, in consideration of its indorsement of such an amount of the bonds of the Maritime Company, not to exceed $100,000,000, as shall be necessary to complete the canal.

Under this arrangement, and according to the estimates of skilled and impartial engineers, the United States will own at least one dollar of stock in the Canal Company for each dollar of bonds that shall been expended in its construction, with a sinking fund, for which the bill provides, of $1,000,000 per annum, invested in the bonds of the company or in other good securities at 3 per cent interest. The entire authorized sum of the bonds, if they were all issued, would be paid off by the sinking fund in a period a little less than fifty years.

It is confidently assumed by the committee that during a period of twenty years after the canal is completed the tonnage of vessels passing through it annually will average 9,000,000 tons, in addition to a very heavy passenger traffic.

The history of the Suez Canal and the St. Marys Canal, on the lakes, give an almost certain basis for this assumption as to the tonnage that will pass through the canal, which falls far below the estimates of a great number of well-informed commercial men.

This calculation of the committee would yield, in revenues annually, not less than $9,000,000, at the rate of $1 per ton, which is less than one-half the toll that is paid on vessels passing through the Suez Canal.

This revenue of $9,000,000 would pay the interest on $100,000,000 bonds ($3,000,000), the cost of the maintenance of the canal, say $3,000,000, and would leave $3,000,000 for the stockholders. But it is not probable that the cost of maintenance would exceed $1,800,000 per annum.

The revenue of the United States from the canal, on this basis, would more than pay the entire cost of the canal in twenty years if it is all placed in a sinking fund and invested annually in the bonds of the company.

Before any bonds of the Maritime Company can be issued under this act, all debts of that company must be canceled, and all contracts for work to be done and all agreements inconsistent with the act are to be rescinded.

To provide an active fund for continuing work now in progress, and increasing it, and for necessary purchases of supplies and material, $1,000,000 of the indorsed bonds are to be issued to the Maritime Company, to be applied only to such purposes and to be credited on the first audit and settlement of the monthly installments for work done on the canal. The Maritime Company, having surrendered its interest in its entire stock, and being prohibited from issuing bonds or the creation of a debt to raise money, and having put all its property under mortgage to the United States, could not obtain the money necessary to proceed with the work on the canal otherwise than by a provision of this sort.

Some additional guards have been provided in this bill to regulate the expenditures of the company in constructing the canal and to subject them to the constant scrutiny and approval of a board of engineers appointed by the United States. But the United States is to have ten directors, in a board of fifteen, in this company, to be appointed by the President and confirmed by the Senate, and of the other five directors the President, voting the stock of the United States, by his proxy, may choose two.

As the persons selected for this important trust must be men of experience, ability, and high character, the security for the proper use of the subvention of the Government, the honest administration of the affairs of the Canal Company, and the proper adjustment of tolls for the mutual interests of the people and the company, is quite as great as the country would have if the ownership of the canal and the sovereign right to control it and to provide for its direction was in the United States.

It is believed that the peculiar constitution of the board of directors gives safeguards and checks against unfaithful or unwise administration of the canal company and its property that are better than we would have if the United States should own, construct, and operate the canal without the intervention of Nicaragua and Costa Rica and the other holders of the stock of the company.

The legislation proposed in this bill does not, in the least degree, trench upon the sovereignty, or the property rights, or the political autonomy of Nicaragua or Costa Rica. Neither does it violate any provision of the Clayton-Bulwer treaty with Great Britain or any rights we may have acquired in Costa Rica, or any treaty of the United States with Nicaragua.

The concessions of Nicaragua and Costa Rica, made to Mr. Menocal and his associates, and all now owned by the Maritime Canal Company of Nicaragua, admit the United States, or any other government, to the full opportunity of acquiring and exercising every right and power of control over this canal that is proposed to be exercised in this amended bill. When we have acquired this power of control over the canal the United States will have no more sovereign power in Nicaragua than now exists under the treaty of 1867 with that Government.

It seems to be justly conceded by the judgment of enlightened men and nations throughout the world that the United States have the natural right to a dominant influence in the control and protection of the canal through Nicaragua, and that the duty rests upon our Government to see that unjust discriminations shall not be made against any nation in the peaceful use of this great waterway. We are the only power on this hemisphere that can secure such guaranties to the lawful commerce of all nations, and the concessions to which this bill relates, and our treaty with Nicaragua of 1867 provides for our active endeavors to make good that pledge to the world.

This bill neither enlarges nor diminishes our rights or powers, as they exist, nor those of Nicaragua or Costa Rica beyond the express stipulations of their respective concessions, but is in harmony with them and with our treaty relations with all governments.

The mortgage and statutory lien provided in the bill for the security of the United States, while of little importance because of the control over the operations of the maritime company secured by the ownership of more than 80 per cent of the stock by the United States, is carefully adjusted in the bill in order to make our security, if that is possible, more complete and to remove all grounds for misunderstandings in the future.

The possible difficulties that might attend a strict foreclosure of the mortgage, upon property in a sister Republic, are of little weight when we consider that the concessions on which this bill is based provide for such a mortgage and carry with this provision the equitable right to such a foreclosure.

It would be in the nature of an impeachment of the honor and integrity of Nicaragua and Costa Rica to anticipate, in our legislation, that either of those States would interpose a national obstacle to the full realization of all that can be justly implied when they permit the concessionaires and their successors to give a mortgage on all the property and all the privileges granted to them, to raise the money to construct a canal of such vast benefit to those States and their people.

The committee refers to this topic only because it has been mooted by some inquiring persons, as a possible objection to the bill, and not because any such question has been intimated by either of those governments. In all dealings between independent nations in matters of this kind something is necessarily left to find its proper adjustment at the time when its solution becomes a practical question for discussion and settlement.

In this instance, the most painstaking care seems to have been taken by Nicaragua and Costa Rica in their respective concessions, and subsequent legislation, to remove every difficulty that could be anticipated that could stand in the way of this great work, and, in this, as in all their dealings with this subject, they have approved themselves to the judgment of mankind as being just, sincere, and liberal.

51st Congress, } SENATE. { Report
2d Session. } { No. 1944.

IN THE SENATE OF THE UNITED STATES.

January 10, 1891.—Ordered to be printed.

Mr. Sherman, from the Committee on Foreign Relations, submitted the following

REPORT:

[To accompany S. 4827.]

To the Senate:

The Committee on Foreign Relations respectfully report that on the 11th day of April, 1890, the Senate, in executive session, adopted a resolution in the following terms:

> *Resolved*, That the Committee on Foreign Relations be, and it hereby is, directed to inquire into what steps have been taken under the act of Congress entitled "An act to incorporate the Maritime Canal Company of Nicaragua," approved 20th February, 1889, and what are the present conditions and prospects of the enterprise; and to consider and report what, in its opinion, the interests of the United States may require in respect of that interoceanic communication.

In obedience to this direction of the Senate the committee entered upon an investigation and consideration of the subject, which they have diligently and exhaustively pursued, and now submit their report thereon with an accompanying bill, the passage of which we earnestly recommend.

Columbus, in his last voyage in 1502, believed that he would find a strait in Central America which would give his vessel a passage through the continent, which he then supposed to be a vast island, to waters at the westward which should bring him into immediate communication with the shores of Asia. He therefore examined the coast of Central America from the bay of Honduras to the Spanish Main. He sought that which did not exist in physical geography. Irving, in referring to his search, says:

> He had been in pursuit of a chimera of a splendid imagination and penetrating judgment. If he was disappointed in his expectations of finding a strait through the Isthmus of Darien it was because nature herself was disappointed. For she appears to have attempted to make one, but to have attempted in vain.

Nature, however, was not much disappointed in her efforts between the two seas at Nicaragua. There is the lowest continental divide (148 feet) between the Strait of Magellan, in latitude 53°–4° south, and the perpetual and all-pervading ice that forms the northern boundary of the English Possessions, in latitude 70° north, between which is a space of 126 degrees of latitude, equal to nearly 9,000 miles.

Almost four centuries have passed since Columbus was baffled in his efforts to reach the tranquil sea and to open direct communication westward from Europe to Eastern Asia, while, during all this time, benignant nature has placed within the reasonable capacity of civilized man the means of making such communication practical and beneficent.

But the great desirability of communication was not lost sight of. In 1551 the Spanish historian Gomara proposed the construction of a passage through the Isthmus and urged on Philip II the attempt to accomplish it on some one of the three routes that have, in recent times, been so often considered and in some respects attempted, viz, Tehuantepec, Nicaragua, and Panama.

Later, and in comparatively recent times, surveys and reconnoissances have been carried on or attempted over almost every part of the Isthmus. Time, research, and experiment have, we think, now demonstrated that the only adequate, efficient, and practicable passage is that by way of Lake Nicaragua. And it is due to the Republic of Nicaragua to say that in the year 1825 the minister of foreign affairs of that country addressed Mr. Clay, then our Secretary of State, on the subject, and appealed to the United States to assist in executing the work of a canal there. He stated that his new-born republic was in the first period of its existence, and said that—

> Nothing would be more grateful to it than a coöperation by this generous nation, whose noble conduct has been a model and the protection to all the Americas; it would be highly satisfactory to have a participator not only of the merit of the enterprise, but of the great advantages which that canal of communication must produce, by means of a treaty which would perpetually secure the possession of it to the two nations.

The executive administration of the United States entered with interest into the consideration of the subject, and Nicaragua was informed that the then newly appointed United States chargé d'affaires to that country would investigate the subject and communicate information upon it to the United States, and that it would then be necessary to consult Congress. It does not appear that the diplomatic officer of the United States obtained any definite information in respect of the feasibility of the enterprise. But Mr. Clay, in his letter to the Commissioners of the United States to the Congress of Panama, observed:

> A canal for navigation between the Atlantic and Pacific oceans should form a proper subject of consideration at the Congress. The vast object, if it should ever be accomplished, will be interesting in a greater or less degree to all parts of the world; but especially to this continent will accrue its greatest benefits; and to Columbia, Mexico, Central America, Peru, and the United States, more than any other of the American nations.

It is evident to the committee that it was the want of precise information, such only as careful engineering, surveys, and estimates could furnish, which left the project unattempted at that time or soon after.

But the hungry instincts of commerce, as well as a deliberate comprehension of its interests and necessities, led, from time to time, to enterprises of one kind and another, inaugurated to accomplish the passage of the Isthmus by a ship waterway.

A new and more powerful impulse and interest arose when, shortly before 1850, the northern portion of Mexico bordering upon the Pacific became a part of the Republic of the United States, immediately followed by the discovery of the enormous resources of the country, not only in the precious metals, but in all those aspects of nature best adapted to the support and development of self-sustaining, civilized, and populous communities.

The construction of such a canal as is now proposed appeared to be an immediate and somewhat urgent necessity. The British had obtained a narrow foothold through so-called negotiations with the Indian chiefs of the Mosquito coast (a geographical phrase of almost unlimited elasticity). British subjects had a "settlement" at the Belize for the purpose of getting and carrying away mahogany and other wood products under an ancient license from Spain.

The British Government had also seized the country at the mouth of the San Juan River, which was the necessary Atlantic end of the canal via Nicaragua. It may be fairly concluded that Her Majesty's Government was solicitous that the United States should not be the controlling party in interest in the construction of the then impending enterprise of a canal; and that the United States were quite as solicitous that a Government of another continent and not republican should not establish itself by conquest, colonies, or dependencies or spheres of influence in the midst of any of the Republics of Central America. Such considerations doubtless led the two Governments to conclude the Convention of 1850 known as the Clayton-Bulwer Convention.

That convention was, as stated in its opening paragraph, one in which the two Governments were to set forth and fix "their views and intentions with reference to any means of communication by ship canal," etc, across the isthmus.

The convention then proceeds to declare that neither of the Governments will ever obtain for itself any exclusive control over the canal "or colonize or assume or exercise any domain over Nicaragua, Costa Rica, the Mosquito Coast, *or any part of Central America*," etc.

It provided for the exertion of the influence of the two Governments in facilitating the construction ot the work by every means in their power. It provided that after completion they will defend its neutrality, with the privilege of withdrawing such guaranty on notice. It provided for inviting other Governments to come into the same arrangement. It provided that each party should enter into treaty stipulations with such of the Central American States as they might deem advisable for carrying out the great design of the convention.

It declared that no time should be unnecessarily lost in commencing and constructing the canal and, therefore, that the two Governments would give their support and encouragement to such persons, etc., as might first offer to commence the same with the necessary capital, etc., and that, if any persons then already had obtained the right to build it from the Central American Government and should fail, each of the two Governments should be free to afford their protection, etc., to any other company that should be prepared to proceed with work.

All these declarations of views and stipulations concerning them were made forty years ago.

During all this time no practical and effective steps in the construction of the canal have been taken until the passage of the act of Congress of February 20, 1889, incorporating the Maritime Canal Company of Nicaragua.

We think it can be justly affirmed that the convention of 1850 has become obsolete, for the convention was based upon the idea of an immediate prosecution of the enterprise of creating this great international water highway, and that neither Government would be found, so far as it regarded the particular question, apart from other considerations, to consider its stipulations as longer binding.

Not only this consideration is to be taken into view, for the course of events in the enterprise and operations of nations has changed entirely the grand commercial situation of the world. The Suez Canal has been constructed and the Government of Great Britain has become, in substance and effect, its dominant and controlling proprietor, thus securing to that Government, in a very large degree, the control of the east and west commerce of the world between the southern and eastern shores of Asia and the whole of Europe and, to a conisderable degree, the eastern shores of the United States and the other American Republics.

We think it may be safely affirmed that had the Government of Great Britain, in 1850, been in possession of the Suez Canal, the United States would never have consented that any canal across the American isthmus should be under the joint control of Great Britain and the United States or under any other European control. In this respect, therefore, the immediate declarations and engagements of 1850 between the two Governments, in regard to an isthmian canal, have become entirely inapplicable, and justly entitle the United States to give its separate aid and encouragement to the construction of such a canal. But this is not all.

One of the provisions of the convention of 1850 most important to the United States and to the preservation of the republican governments on this continent was that which declared that neither party to the convention should "occupy or fortify or colonize or assume to exercise any dominion over Nicaragua, Costa Rica, *the Mosquito coast, or any part of Central America.*"

At that time the "settlement" of British subjects, as it was called, at the Belize, on the coast of Central America, was of the smallest dimensions, and had no substance or form of a territorial dominion. British woodcutters were there under an ancient Spanish license of timber cutting, and nothing more. These settlers in a country not belonging to the British Crown had, off and on, attempted to form a kind of local government for preserving order among themselves, and, after going through various phases, had reached the point, in 1850, of some local magistrates and an imperial superintendent, merely and clearly for the purpose of preserving internal order among the English adventurers engaged in the lumber trade in that foreign country.

This was substantially the condition of things when the convention of 1850 was entered into.

The next step taken, after the convention of 1850, was in 1853, when a legislative assembly was constituted to manage the affairs of the settlement. This was followed by a convention between Great Britain and Guatemala, in 1859, for the establishment of the boundaries between what the treaty chose to call "Her Britannic Majesty's settlement and *possessions* in the Bay of Honduras" and the territories of Guatemala. The country, or the largest part of it, belonged to Guatemala as the successor to all the sovereign territorial rights of Spain in that region; but by this treaty that which was before a licensed industrial establishment became instantly a possession of the British Crown. The settlement government continued until 1862 when the settlement was declared a colony of the British Crown and a regular colonial establishment was set on foot; and so from that time to this, the form and substance of a regular colonial government as a part of Her Majesty's dominions has continued. It is understood that its geographical dominion has been vastly enlarged from the licensed wood-cutting limitations and boundaries that existed in 1850. All this has taken place systematically and persistently notwithstanding the declaration of Her Majesty's Government that it should not "colonize or assume or exercise any dominion over * * * the Mosquito coast or any port of Central America".

If these proceedings of her Majesty's Government, in respect of one of the most important subjects of the convention and in absolute opposition to it, do not discharge the United States from all and every of their declarations and engagements stated in that convention, it is impossible to conceive what could.

In view of all these considerations the committee is of opinion that the United States is at present under no obligation, measured either by the terms of the convention, the principles of public law, or good morals, to refrain from promoting, in any way that it may deem best for its just interests, the construction of this canal, without regard to anything contained in the convention of 1850.

These observations are submitted as a part of the historical and diplomatic consideration of the subject, the omission of which might lead to the implication that the committee are opinion that the convention of 1850 is still in force and of binding obligation on the United States, but we think there is nothing in the provisions of the bill now reported which is inconsistent with any of the engagements of the United States entered into in 1850, as stated in that convention.

In view of some of the events following the convention of 1850 the United States in 1867 entered into a treaty with the Republic of Nicaragua by which that Republic granted to the United States, for its citizens, the right of transit between the two oceans, on any route of communication, natural or artificial, whether of land or water, that might be constructed, to be used upon equal terms by the citizens of the two Republics.

This treaty of 1867 is still in force and would, we think, of itself justify the United States in undertaking to aid the construction of the Nicaragua Canal. In 1884 the President of the United States negotiated a treaty with the Republic of Nicaragua providing for the construction of the canal by the United States and under arrangements that preserved the sovereignty of Nicaragua and secured to all the Central American Republics, as well as the United States, the benefits of the enterprise.

That treaty was submitted to the Senate in December, 1884, but before its final disposition it was withdrawn by the President on the 13th of March, 1885, for further consideration, and has not been again submitted to the Senate for reasons stated by him and mentioned further on. Afterwards, in 1887, the Republic of Nicaragua, supposing, apparently, that the treaty which had been negotiated would not go into effect, made a concession of the right to build the canal to a private association of citizens of the United States (known as the Nicaragua Canal Association), through Mr. A. G. Menocal, who had been one of the engineers employed by the United States in making surveys there.

That concession explicitly provided, first, for the exclusive privilege to build and operate the canal for ninety-nine years. It provided that the concession might be taken by a company of execution to be organized by the association, which is the company chartered by Congress February 20, 1889. It provided that the people of all nations should be invited to contribute capital on a certain notice, which notice, the committee understands, has long since been given. It provided for a reservation of 5 per cent. of the subscriptions to the Central American Republics. It provided that shares not so taken should be subject to the free disposition of the company. It provided the respective terms and time within which work should be commenced and, in general, the rapidity with which it should be carried on. It provided that the Government of Nicaragua should receive 6 per cent. of the total amount of the issue of the stock, etc., as compensation for the grant.

It made other provisions in respect of detail, protection, management, etc., analogous to those usual in statutes granting corporate privileges for public works. Later the Republic of Costa Rica assented to the arrangement so far as her interests were concerned.

Pursuant to the provisions of this concession Mr. Menocal and his associates, all citizens of the United States, became incorporated as the Maritime Canal Company of Nicaragua, under the act of Congress of February 20, 1889.

This last-named company has since proceeded with the work in conformity with the terms of the concession and with the act of incorporation. The extent, nature and physical characteristics of the work are stated in another part of this report. In immediate connection, however, with the preceding meager historical statement, it may be most convenient to state the general geographical, commercial, and political situation of the subject viewed in its broader aspects.

It is self-evident from climatic considerations that the great bulk of the commerce and intercourse of the world must move on eastward and westward lines. A glance at any modern map of the world on Mercator's projection will show the geographical relations of seas and continents and the arrangement of the present commercial lines of ocean and land transit; it will show how perfectly correlative, in these respects, the Central American isthmus is to the Isthmus of Suez.

It will be seen also that, while the Suez Canal is immediately most important to the commerce of the whole of Europe with southern and western Asia, the Nicaragua Canal is immediately and most largely important to the great body of the Republics of North, Central, and South America.

The Nicaragua canal will bring into the utmost possible near communication the eastern and western shores of North America, and, in like manner, it will bring into the utmost possible short communication the eastern and western shores of South America, and it will bring the western shores of South America into direct communication with the eastern shores of North America, and the eastern shores of South America into direct communication with the Western shores of North America, thus making the short passage of the Isthmus the grand key and common gateway of friendly communication between the republics that now occupy substantially the whole of the habitable parts of both the continents of North and South America.

Not only will this be accomplished, but the great lines of the world's trade by sea will be, by this canal, very much shortened, and the perils of navigation and the asperities of climate will both be immensely diminished. We submit herewith for consideration in this connection a table (marked Appendix 1) showing some of the savings of distance in sea navigation by the use of this canal.

We think it quite unnecessary to speak at large of the great political considerations attending the construction of this work under the patronage of the governments and citizens of the United States and the republics whose territorial and sovereign interests are directly concerned in it.

These considerations are not those that look to hostile or adverse dealing with the other nations of the globe, but such as look to giving the benefits of the opening of this great "secret of the strait" to the whole family of civilized mankind, always under such just and considerate administration as shall promote to the utmost degree the harmonious and intimate intercourse of all the republican governments which now, as we have said, occupy, almost entirely, the two great western continents, and such as shall enable them to protect and improve themselves commercially and otherwise in their republican and commercial development and prosperity.

THE PRESENT CONDITION OF THE WORK ON THE NICARAGUAN CANAL GIVES A STRONG ASSURANCE OF ITS EARLY COMPLETION.

The work has advanced rapidly and with such uninterrupted success that some of the most important parts of it have already been accomplished. This is especially true as to the engineering and the clearing of the line of the canal and the building of a railroad preparatory to the dredging of the channel.

Nature has placed within the convenient reach of science and labor the requisite conditions for the location of this great ship canal, and the material for its construction at a very low cost as compared with other similar enterprises. When it is constructed on the plan and on the ocation selected it will for ages furnish ample water way, convenience, and security to the fleets of all nations that may pass through this canal from ocean to ocean.

The enthusiasm naturally excited by the magnitude and importance of such a work is appreciated by the committee, and has increased their caution in presenting only such facts in their report as are well authenticated, and such conclusions as they seem to fully sustain. The reports and papers herewith submitted, as appendices to this report, and to support the recommendations of the committee, come from sources that are worthy of full credit. They are, first, a paper read by A. G. Menocal, chief engineer of the Maritime Canal, in July, 1890, at the Fourth International Congress on Inland Navigation, Manchester, which is marked Appendix A.

Second. A special report by Charles T. Harvey, civil engineer, on the maritime canal of Nicaragua, and data relating to the ship-canal facilities and traffic of the Lake Superior basin, marked Appendix B.

Third. The report of Frank P. Davis, division engineer of the company, dated at San Juan Del Norte, Nicaragua, October 19, 1890, covering also the report of Chief Surgeon J. Edward Stubbert, dated November 1, 1890, marked Appendix C.

Fourth. A paper issued by the Maritime Company in 1890, entitled "The Maritime Ship Canal of Nicaragua", marked Appendix D.

Fifth. An article from the Engineering News, of dates the 14th and 11th September, 1889, marked Appendix E.

Sixth. An article published in the California Banker's Magazine, in October, 1890, by William L. Merry, marked Appendix F.

Seventh. The report of A. G. Menocal, of January 1, 1890, and a report from five civil engineers, selected by the Maritime Canal Company, to revise the report and estimates of A. G. Menocal, chief engineer, marked Appendix G and H.

After Mr. Menocal had completed the surveys required for the permanent location of the route of the canal he requested the company to select a board of engineers of the highest skill and experience to thoroughly examine his report, and to revise his estimates of the cost of the canal. This was done with due care and impartiality. His estimates were increased by $14,633,262, to cover contingencies which include every possible increase of the cost of the work from causes within the range of probable conjecture.

These calculations and results have also been critically examined by many of the leading engineers of the world, without any practical dissent from the main propositions in Mr. Menocal's reports. The attention of scientific engineers, and of various governments, has long been directed to this proposed transit for ships across the Isthmus of Darien, and it may now be stated as the final concensus of opinion, based on many surveys, that the Nicaraguan route is the most feasible and the least costly of all the routes that have been projected for a ship canal across that barrier. It can now be assumed as a fixed and reliable fact that the best location of the axis of the canal has been selected for this work.

The statements and opinions of Mr. Merry, as expressed in Appendix F, are those of an experienced navigator, who was for many years the president of the San Francisco Board of Trade. They also reflect the opinions of the people of the Pacific coast, who have most carefully studied this subject, as to the wisdom of the policy indicated in the bill herewith submitted to the Senate.

The committee respectfully invite attention to the great force and effect of the facts presented in these several papers as to the value of this ship canal, and the comparatively small expenditure required to secure to all the nations and peoples of the earth the benefits of this highway for travel and commerce, that connects all the great oceans and seas of the globe.

The canal, as it is located, after patient, careful, and skillful examination, has features of great and peculiar advantage that are not found elsewhere in the world for a work that can approximate it in its importance to mankind. It has for its crest line and reservoir the deep lake of Nicaragua, that is fed through a narrow outlet by Lake Managua to the northward, where the heavy torrents from the rainfall in the mountains are caught and imprisoned. Lake Nicaragua is a rock-bound basin, with a single outlet, called the San Juan River.

This outlet has a deep and constant current of water, without any natural obstructions or sudden falls, and is never flooded with a rise of more than 4 or 5 feet by the heaviest rainfalls, so that it is a safe feeder for the ship canal. The difference in the volume of water discharged between the highest and lowest water in the lake is about 1,000 feet per second. The distance from the Caribbean Sea at Greytown to the Pacific Ocean at Brito is 169.448 miles, all of which will be slack-water navigation except 26.783 miles, which is the length of the prism of the canal, making 142.659 miles of free navigation. A dam at Ochoa, on the San Juan River, the "divide" between the San Francisco River and the Deseado, about 16 miles from Greytown, and a dam at Tola, within 4 miles of the Pacific coast, with a short interval of canalization, extend and establish a clean surface level of 153¼ miles over the whole distance of 169½ miles between the oceans.

For the exact measurement of these distances the committee refer to the papers appended to this report. It has impressed the committee that this route has very important advantages in the fact that such a great distance of slack water navigation is secured by the erection of two dams at places where the structures can easily be made entirely secure by the use of material found in abundance along the line of the canal. The surveys for this work were made with the greatest care. They average about 40 miles of preliminary lines to 1 mile of actual location.

At Ochoa, on the San Juan River, below the entrance of the San Carlos River, flowing northward from Costa Rica, the line of the canal diverges to the eastward, while the flow of the united rivers is to the southward.

Behind a range of low hills a valley, or basin, was found, into which the waters of the San Juan will be forced by the dam at Ochoa. In this basin about 9 miles of water at the level of Lake Nicaragua will form a vast estuary and dispense with the necessity of excavating the canal. Another important result is that the canal is beyond the influence of any flood that may occur from the united volumes of the San Juan and San Carlos rivers in the rainy season.

The skillful thoroughness of the surveys have secured a location for the canal that includes every possible advantage that the topography of the country and the easy and cheap control of the best material for its contruction affords.

The dams, banks, slopes, aprons, drains, weirs, locks, and waste-ways have been so located as to assure the permanency of the work.

The quarries of stone along and near to the line of the canal while increasing the cost of excavation, strengthen the work and are of great advantage in the construction of locks and dams and in the building of bridges, piers, moles, and breakwaters and quays in the harbor.

Confronted with the great difficulties that are described in the report of Mr. Davis, and within about twelve months of actual operations, a solid pier has been extended about 1,000 feet into the sea, where the natural depth of the water is 14 feet. The channel to the leeward of this pier is rapidly deepening by the action of the sea and will soon be of sufficient depth to admit the passage of the largest vessels. A safe harbor for the largest ships at the entrance of the canal may now be considered as being assured at a very moderate expense.

Pure cold water is brought in steel pipes for a distance of 10 miles from the hills back of the city of America, on the coast. This gives much security to the health of those employed on the canal.

Provision for the health and comfort of all classes of employés has been carefully made by the company, and the results have been entirely satisfactory, as they are shown in the reports of the surgeon in chief.

The building of storehouses and accommodations for the comfort of the laborers, and providing them with good, wholesome food and clothing, has been of great advantage to the enterprise. All the work done by the company has been attended with careful regard to economy.

The heaviest part of the labor of clearing the dense forests from the line of the canal has been accomplished.

The great swamp of the Deseado River has been crossed with this clearing and the firm ground of the hills has been reached, where the forests are comparatively light and the wood is better for construction purposes. The wood found in the swamps being of light and soft texture decays rapidly, and in the dry season the felled forests are readily destroyed with fire. Between 10 and 12 miles of railroad has been built through this great swamp, and is ballasted with sand. It may be classed as a good and permanent road that supports heavy trains drawn by locomotives of 30 and 40 tons burden, and is sufficient for all the purposes of the construction of the canal, so far as it has been built.

This road is surveyed and located to its terminus at Ochoa, to which point a line of telegraph is in operation from Greytown.

The report of Mr. Davis shows the work that has been done on the Pacific Division of the canal and the great quantity of material and machinery that has been collected there, indicating enlightened and systematic industry and zeal on the part of the company.

This company has engaged the confidence of the Governments and people of Nicaragua and Costa Rica as to its ability and faithful purpose to construct the canal. Their earnest coöperation, thus secured, is an important element of success.

The committee consider that it is not necessary to recapitulate the facts, so fully stated in the papers appended to this report, as to the details of the work on the canal and its cost. No important facts are omitted, and none are unduly colored in statement, so far as the committee have been able to discover.

In some of these papers comparisons are made between the cost of this work and of its engineering difficulties with those works that enable sea-going vessels to reach Lake Superior from tide water on the St. Lawrence River.

Perhaps an accurate estimate cannot now be made of the cost of opening, maintaining, and improving the Welland Canal and the locks at Sault St. Marie, but the lowest calculation will bring the cost up to two-thirds of the sum that the Nicaraguan Canal will cost. The difference in elevation to be overcome is about 500 feet in favor of the route through lake Nicaragua, and the other physical difficulties are greater than those found on the Nicaraguan Canal. When the commerce of the Atlantic and Pacific Oceans is compared with that of the basins of our northern lakes it is obvious that the tonnage that will pass through the Nicaraguan Canal will be many times greater than that through our lakes in the interior.

Mr. Harvey in his report puts this matter in this strong light:

> If the tonnage of this canal route upon a water-course composed of a cluster of inland lakes, paralleled through their entire length by railways on both of their borders, and with competing adjacent water-courses as shown, has actually increased from 1,567,741 tons of freight in 1881, to 6,411,423 in 1888, and, presumably to 7,500,000 tons in 1889, what must be the traffic of the ship canal which bisects a hemisphere, saves 10,000 miles and fifty days of freight-steamer time between New York and San Francisco, and economizes proportionately in time and the distance to and from innumerable other commercial centers?

Mr. Harvey also estimates the freight tonnage passing through the Suez Canal in 1889 at 6,800,854 tons, which is 709,168 tons less than that of the Lake Superior Canal at Sault Ste. Marie.

There seems to be no reason to doubt that the Nicaragua Canal will be completed within six years from the date of the passage of the bill herewith reported to the Senate, and that commerce will force its way in ships from ocean to ocean, for the necessities of every maritime country coincide in an urgent demand for the early completion of this work.

SHALL THE GOVERNMENT OF THE UNITED STATES AID IN THE CONSTRUCTION OF THE CANAL.

The closing direction of the Senate is that this committee report its opinion as to what the interests of the United States may require in respect to the Nicaragua Canal, or, in other words, whether in view of existing circumstances it is for the interest of the United States to directly or indirectly aid the Maritime Canal Company in the execution of the work proposed, and if so to what extent and in what manner. This depends upon the ability of the Maritime Canal Company to construct the canal upon the basis of actual cost, so that the tolls and charges need not exceed a fair interest on such cost and the expense of maintenance and administration.

It is a matter of the highest importance that the charges upon the commerce of the world for the use of the improvement should not be enhanced by interest and dividends on stock and bonds far in excess of the actual cost. It became therefore the first duty of the committee to ascertain whether the Maritime Canal Company intended to or could limit the stock and bonds of the company to the amount of money actually expended, and, if not, what additional stock or bonds would be required to cover contractors' risks, bankers' discounts, and bonus granted to induce investors to incur the real and imaginary risks of an investment that could yield no income until the work of six or seven years was completed.

Your committee therefore called before them the officers and engineers of the Maritime Canal Company, and also of the Construction Company employed by the Maritime Company to actually construct the work, to ascertain what contracts and agreements had been made between them and what plan was proposed to raise the large sum of money needed. A copy of the statements made and the documents furnished in the process of this examination are made a part of this report.

It appears from the estimate of A. G. Menocal, chief engineer, dated January 31, 1889, to the president and board of directors of the Nicaragua Canal Construction Company, that the cost of the work proposed, without interest and contingencies, was $65,084,176. It also appears by the report of the board of consulting engineers, revising the reports of the chief engineer, that the estimated cost is increased to $73,166,308. To this estimate they add for certain specified and unspecified contingencies of construction $14,633,262, making the total estimate $87,799,570. These estimates are based upon a plan of construction which contemplated that the work could be completed within six years. The interest accruing on the money actually invested as the work progressed, at the rate of 5 per cent., if the work was completed within six years, assuming an equal expenditure each year during the period of construction, would be equivalent to 15 per cent., or $13,000,000, making the aggregate of expenditure of money and accruing interest thereon for the full completion of the work of about $100,000,000.

This estimate, your committee is of the opinion, from such judgment as it can form upon the documents furnished, is a reasonable estimate of the cost of the completed work if paid for in money. There are elements of unavoidable contingencies which may largely increase this cost, such as grave financial disturbances that may advance the rate of interest, such legislation as will diminish the purchasing power of money, possible contingencies arising out of disturbances in the local governments of Costa Rica and Nicaragua, and from natural convulsions, storms, or earthquakes, which can not be foreseen and of which there is no reasonable fear. The estimates of the actual cost of the work and of contingencies seem to be sufficiently liberal to cover all probable expenditures, and lead your committee to the belief that the amount stated, $100,000,000, if furnished as needed without delay or impairment of value will be ample to complete the work proposed.

It became important in the first instance to ascertain how it was proposed by the Maritime Canal Company that this large sum should be raised. The statement of Mr. Hiram Hitchcock, president of the Maritime Canal Company of Nicaragua, and of Hon. Warner Miller, president of the Nicaragua Canal Construction Company, show clearly the plans proposed by the two companies to raise the money requisite.

The act incorporating the Maritime Canal Company of Nicaragua provides that the capital stock of said company shall consist of not less than 1,000,000 shares of $100 each, or $100,000,000, with the right to increase the capital stock to 2,000,000 shares of $100 each, or $200,000,000 on the vote of two-thirds of the stock of said company at any time outstanding. It also authorizes the company in the construction of said canal, and to carry out the purposes of the act, to issue its bonds and secure the same by mortgage on its property and rights of property of all kinds and descriptions, real, personal, and mixed, including its franchise to be a corporation. The amount of said bonds is not limited, but assuming, as the act contemplates, that it would be equal to the amount of stock outstanding, the amount of stock and bonds might range from $200,000,000, to $400,000,000, with authority to increase the amount of bonds to an indefinite extent.

Under the provisions of this charter the Maritime Canal Company entered into a provisional contract by which the canal company agreed to pay the Construction Company for the work proposed stock to the amount of $92,500,000, being the total stock authorized, less concessions to Nicaragua and Costa Rica, and $150,000,000 in bonds, an aggregate of $242,500,000. It was assumed that the bonds of the company, bearing interest at 5 or 6 per cent. per annum, could be sold at the rate of about 60 cents on the dollar, the rate at which the first bonds of the Suez Canal were sold. The stock was to be given to the contractors as a bonus to induce them to undertake the contract. In view of the difficulties in the way of the enterprise, your committee is of the opinion that the contract was as favorable a one as could be made, if we may judge by the contracts made for similar undertakings by private companies and in view of the risks and hazards of the future. The ability of the Construction Company to perform the work, even for this great sum, would depend entirely upon its ability from time to time to sell the securities of the Maritime Company.

Any stringency or fluctuation in the money market might prevent their sale and thus arrest the progress of the work. Any neglect on the part of the Governments of Nicaragua and Costa Rica to protect the contractors in the performance of the work would necessarily add to its cost, and, perhaps as in similar enterprises disable the company and forfeit their charter privileges. Any failure of the bankers purchasing these securities to pay for them according to the conditions of the sale would have the like effect. The work is so great and the benefits of its completion so transcendent that it would seem that its execution should not be left to private enterprise that, in the chances of the future, may fail. It is doubtful whether any private company, corporation or combination, however strong it may appear, would be able to complete so great an enterprise, one that could yield no income during its progress and could not in any event yield profit until after the whole enterprise was completed. Unlike railroads, the investment could not yield any income or profit until it was demonstrated by actual trial that commercial vessels could pass from ocean to ocean with reasonable facility and without delay or danger. In whatever view the committee could take of the enterprise there appears grave doubt whether it could be executed without the strong, certain, and powerful support of a great nation or a combination of nations.

Even if completed upon the plan proposed, the amount of stock and bonds outstanding would at 5 per cent. require that the tolls and other income of the company would yield $12,500,000 a year, a sum that would be so great a burden on the commerce of the world as to leave it questionable whether vessels would pass through the canal or follow the old course of navigation around Cape Horn. The gentlemen engaged in the enterprise are confident of their ability to execute the work. They did not express a desire for aid but seemed to have entire confidence of their success. They have already expended, as we are advised, about $4,000,000 and are negotiating contracts and loans.

The committee, however, felt grave doubts, and it was apparent that at all events the necessities of the company would compel them to sell their stock and bonds in the best market at a large discount. The stock and bonds would naturally flow into the hands of European bankers, and with them the ultimate control and government of the canal. For more than seventy years the United States has carefully adhered to the policy of the noninterference of European powers with the integrity or autonomy of American nations. This canal will be to the United States a part of its coast wise channel from the Atlantic States to the Pacific States. The concessions made by Nicaragua and Costa Rica are to an American company with stipulations and privileges in favor of the United States. The interests of the people of the United States are much greater in the proper management of the canal and in its free use at reasonable tolls than any foreign power.

The Maritime Company as now organized may be trusted to protect the interests of American citizens, but its willingness to do so may be changed by a change in the ownership of stock. Many examples of that kind have occurred when combinations and even foreign governments have bought the majority of the stock of a corporation with a view to its control. To leave the interests of the people of the United States dependent upon the cupidity of a corporation controlled necessarily by its changing its pecuniary interests and which may fall under the influence of rival powers would be to surrender the great advantages expected by our people from the use of the canal in shortening by over 10,000 miles the passage of vessels from our ports on the Atlantic to our ports on the Pacific, as well as to endanger the vast trade that it is expected will spring up from the United States through the canal to the western ports of South America and to Asia and Australia. While the United States does not desire to have a monopoly of these benefits, but is willing upon just considerations to share them with all the nations of the world, yet we are more deeply interested than any other in making the burden of this transit as light as possible, and to secure its completion at a sum the interest of which will not be too great a burden upon commerce.

These considerations led your committee without division to the conclusion that it is the interest of the United States to make such a contract with the Maritime Canal Company as would certainly assure the completion of the canal within the period of six years at its actual cost in money, to be represented by bonds of that company guarantied by the United States, which in any state of the money market would be sold at not less than par, the United States to be indemnified against liability on its guaranty by a pledge of a majority of the capital stock of the company with power to vote such stock. Thus, without loss to the United States, it would secure the early and complete construction of the work at its actual cost and such reasonable control of the transit as would give to our citizens at least equal advantages in the use of the canal.

In this way, assuming that the estimate of the cost of the canal is reasonable, which the committee propose to have tested by United States engineers, the United States could secure to the people of Nicaragua and Costa Rica (who from their position are most interested in the canal), to the people of the United States, who will probably maintain the largest commerce over it, as well as to all the nations of the world, the use of the canal at the lowest tolls that will reimburse and save harmless the United States from its guaranty, and yet will yield to the actual builders of the canal moderate profits, without watered stock or discredited bonds resulting in unnecessary burdens upon vessels passing through its waters.

This has been the object of the United States in all the treaties made and negotiations had with the Central American States and other foreign powers during a period of seventy years. Every President since and including Mr. Monroe has participated in this negotiation, and all of them have favored the construction of an interoceanic canal from the Atlantic to the Pacific across the isthmus to be practically under the control of the United States, but to be open to the commerce of the world. To secure the best practicable route the United States has conducted many elaborate and expensive surveys, with full details as to every route proposed from Mexico to Colombia, resulting in the concurring judgment of nearly all the engineers and officers of the Army and Navy that the route proposed by way of Lake Nicaragua is the best.

In communicating some of these surveys to the Senate, President Hayes thus stated the American doctrine in respect to the proposed canal:

> The policy of this country is a canal under American control. The United States can not consent to the surrender of this control to any European powers. If existing treaties between the United States and other nations, or if the rights of sovereignty or property of other nations stand in the way of this policy—a contingency which is not apprehended—suitable steps should be taken by just and liberal negotiations to promote and establish the American policy on this subject, consistently with the rights of the nations to be affected by it.
>
> The capital invested by corporations or citizens of other countries in such an enterprise must, in a great degree, look for protection to one or more of the great powers of the world. No European power can intervene for such protection without adopting measures on this continent which the United States would deem wholly inadmissible. If the protection of the United States is relied upon, the United States must exercise such control as will enable this country to protect its national interests and maintain the rights of those whose private capital is embarked in the work.
>
> An interoceanic canal across the American isthmus will essentially change the geographical relations between the Atlantic and Pacific coasts of the United States, and between the United States and the rest of the world. It will be the great ocean thoroughfare between our Atlantic and our Pacific shores, and virtually a part of the coast line of the United States. Our mere commercial interest in it is greater than that of all other countries, while its relation to our power and our prosperity as a nation, to our means of defense, our unity, peace, and safety, are matters of paramount concern to the people of the United States. No other great power would, under similar circumstances, fail to assert a rightful control over a work so closely and vitally affecting its interest and welfare.

Mr. Evarts, then Secretary of State, in the same connection said:

> The natural interest of the United States in any connection through the American Isthmus has not only been always emphatically expressed by the government, but it has been fully and distinctly recognized by other governments from the earliest period of our national existence.

By the treaty negotiated in 1884 between the United States and Nicaragua the canal was to be built by the United States. It was still pending in the Senate when Mr. Cleveland became President. He withdrew it, not from opposition to its general purposes, but because, as he states in his annual message of December, 1885, it was "coupled with absolute and unlimited engagements to defend the territorial integrity of the States where such interests lie." He held that this clause was an "entangling alliance," inconsistent with the declared public policy of the United States. This objection led to the concessions by Nicaragua and Costa Rica to private persons, and the incorporation by the United States of the Maritime Canal Company of Nicaragua.

These concessions and the charter provide expressly that the United States may aid the company by a subscription of stock or otherwise. If such aid is rendered it must be rendered now. If the Maritime Canal Company is to enter the money market without our aid as a borrower of $100,000,000 to be expended within six years, it must execute its mortgage now for an amount that will probably yield that sum as needed. The swollen cost will largely fall upon the people of the United States in the form of tolls. If the work is, as we confidently believe, one of transcendent value to the United States—worthy to be done by a great nation—which will cost only its credit without being a burden to the taxpayer, one that will not in any event cripple its resources, but will be a monument of its power and its beneficence more enduring than the monuments of antiquity, a realization of the dreams of all nations for four centuries, it ought to be undertaken not by a corporation alone, but aided by the United States for the benefit of the American continent and the commercial world. It is an act worthy to commemorate the beginning of the second century of our existence as a nation and of the public policy upon which we have entered of uniting the Republics of America by works of peaceful development.

The practical difficulty of the committee was in determining in what manner and to what extent the United States should aid in this enterprise. Nicaragua and Costa Rica were quite willing that this Government should directly construct the work, but for the reasons stated the treaty for this purpose was not ratified. The Maritime Canal Company was interposed by act of Congress. Composed exclusively of citizens of the United States, they were not desirous of surrendering what they regarded as a favorable business enterprise. The plan proposed in the accompanying bill was dictated by this committee, and, after many conferences, agreed to by that company, subject to the approval of Congress. The company is now actively engaged in construction, and it is but fair to it that if the bill is to become a law Congress should act as speedily as possible, so that the company may not be delayed in its contracts.

The bill herewith reported is founded upon the theory that the cost of the completed work shall be represented only by bonds and stock to the amount of money actually spent in construction and the accruing interest paid in its progress.

The bill proposes to limit the stock of the Maritime Canal Company to 1,000,000 shares of $100 each and no more. By the concessions of Nicaragua that country is entitled to 6 per cent. or $6,000,000 of the stock of the company for the liberal grants made to and privileges conferred by that country upon the Maritime Construction Company, a copy of which is hereto attached. Costa Rica for similar concessions on her part is entitled to $1,500,000 of this stock.

By the terms of these concessions the Maritime Canal Company became entitled to $12,000,000 of the capital stock, and this amount has been, by the agreement with the Construction Company, transferred to the latter company. The agreement heretofore referred to between the Maritime Company and the Construction Company provided for the transfer of the residuum of the stock and also 150 million dollars of bonds to be issued in payment for the work as performed. By that agreement the ownership and control of both companies would follow the ownership of the stock and bonds. By the bill proposed all certicates of stock and all contracts, assignments, and transfers of stock other than the stock to which the Governments of Nicaragua and Costa Rica are to be surrendered and canceled, except the sum of $3,000,000, which is to be retained by the Maritime Company or its stockholders in full payment and satisfaction of the concessions and agreements and advantages obtained by them.

The United States is to reimburse the Maritime Canal Company the amount expended in promoting the enterprise and in the surveys and construction of the work thus far performed, including all expenditures in connection therewith upon statements to be made, but subject to the approval of the Secretary of State and the Secretary of the Treasury. The canal shall thereafter be constructed from the proceeds of the bonds of the Maritime Company, guarantied, as aforesaid, in payments as the work progresses, not less frequently than every sixty days. All contracts or engagements of whatever name or nature now existing or outstanding not consistent with the provisions of the bill are to be canceled and set aside, and the work is to be proceeded with upon estimates made by United States engineers and to be paid for at actual cost by bonds, or the proceeds of bonds, of the kind and description mentioned. All the expenses of the work, including interest on the guarantied bonds issued, are to be paid by the Maritime Canal Company of Nicaragua, and upon the failure of said company to pay the interest as it accrues, it is to be paid by the United States. The interest proposed on the bonds is 3 per cent., payable quarterly, and running for a period of twenty years.

To indemnify the United States from all liability upon its guaranty $70,000,000 of stock of the Maritime Company is to be deposited with the Secretary of the Treasury and no stock other than that already named is to be issued except when, in the opinion of the President of the United States, the installments of the mortgage bonds shall be insufficient to meet the current requirements of the company in respect to the enterprise. The Secretary of the Treasury has power, at his discretion, to vote the stock pledged to the United States, either in person or by proxy, at any meeting of the stockholders of said company, and the United States is entitled to a representation of six members upon the board of directors composed of fifteen persons.

These, in brief, were the terms suggested by your committee to the Maritime Canal Company and the Construction Company, and, after many conferences, a full report of which is hereto attached, the officers of said companies agreed to the terms and conditions proposed. This bill, if it should become a law, would, in the opinion of your committee, secure, without reasonable doubt, the prompt completion of the Nicaragua Canal at its actual cost, and secure to the United States a reasonable and proper control in conformity with the concessions granted by Nicaragua and Costa Rica. The management and conduct of the work is left with the Maritime Company, but under such restraints as will insure economy and with the strongest inducement to limit its obligations to the actual cost of the work, so that the tolls upon it will not be swollen to pay for watered stock or bonds of doubtful credit.

The United States becomes a party strong enough to cope with the magnitude of the enterprise, and to give confidence not only to its securities, but to its safety from injury from internal or external forces. It is believed by your committee that the United States will not be called upon to pay any portion of the principal or interest of the bonds, but that the work itself will amply repay all its cost, and yield its benefits not only to the people of Nicaragua and Costa Rica, but to the civilized world. If it appeared at any time that the interests of the United States are in jeopardy from any cause, it can purchase the majority of the stock and become the controlling owner of the canal by paying its own bonds to an equal amount, and the property, tolls, income, and profits of the canal will be an ample security against the obligations it assumes.

The committee therefore recommend the passage of the bill.

JOHN SHERMAN, *Chairman.*
GEO. F. EDMUNDS.
WM. P. FRYE.
WM. M. EVARTS,
J. N. DOLPH.
JOHN T. MORGAN,
JOSEPH E. BROWN.
H. B. PAYNE.
J. B. EUSTIS.

APPENDIX 1.

TABLE SHOWING DISTANCES IN MILES BETWEEN COMMERCIAL PORTS OF THE WORLD AND DISTANCES SAVED BY THE NICARAGUA CANAL.

From—	Via Cape Horn.	Via Cape of Good Hope.	Via Nicaragua Canal.	Distance saved.
	Miles.	*Miles.*	*Miles.*	*Miles.*
New York to—				
San Francisco	14, 840	....	4, 946	9, 894
Behring Strait	17, 921	....	8, 026	9, 895
Sitka	16, 105	....	6, 209	9, 896
Acapulco	13, 071	....	3, 122	9, 949
Mazatlan	13, 631	....	3, 682	9, 949
Hong-Kong	18, 180	15, 201	11, 038	4, 163
Yokohama	17, 679	16, 190	9, 363	6, 827
Melbourne	13, 502	13, 290	10, 000	3, 290
New Zealand	12, 550	14, 125	8, 680	3, 870
Sandwich Islands	14, 230	....	6, 388	7, 842
Callao	10, 689	....	3, 701	6, 988
Guayaquil	11, 471	....	3, 053	8, 418
Valparaiso	9, 750	....	4, 688	5, 062
New Orleans to—				
San Francisco	15, 052	....	4, 047	11, 005
Acapulco	13, 283	....	2, 409	10, 874
Mazatlan	13, 843	....	2, 969	10, 874
Guayaquil	11, 683	....	2, 340	9, 343
Callao	10, 901	....	2, 988	7, 913
Valparaiso	9, 962	....	3, 987	5, 975
Liverpool to—				
San Francisco	14, 690	....	7, 694	6, 996
Acapulco	12, 921	....	5, 870	7, 051
Mazatlan	13, 481	....	6, 430	7, 051
Melbourne	13, 352	13, 140	12, 748	392
New Zealand	12, 400	13, 975	11, 349	1, 051
Hong Kong	18, 030	15, 051	13, 786	1, 265
Yokohama	17, 529	16, 040	12, 111	3, 929
Guayaquil	11, 321	....	5, 890	5, 431
Callao	10, 539	....	6, 449	4, 090
Valparaiso	9, 600	....	7, 436	2, 144
Sandwich Islands	14, 080	....	9, 136	4, 944
Spain to Manilla	16, 900	13, 951	13, 520	431
France to Tonquin	17, 750	15, 201	13, 887	1, 314
Hamburg to—				
Mazatlan	13, 931	....	6, 880	7, 051
Acapulco	13, 371	....	6, 320	7, 051
Fonseca	11, 430	....	5, 530	5, 900
Punta Arenas, Costa Rica	11, 120	....	5, 515	5, 605

From—	To eastern entrance of Nicaragua Canal.	From—	To western entrance of Nicaragua Canal.
	Miles.		*Miles.*
New York	2, 021	San Francisco	2, 776
Liverpool	4, 769	Valparaiso	2, 518
Hamburg	5, 219	Callao	1, 531
Amsterdam	4, 994	Portland	3, 219
Havre	4, 874	Victoria	3, 428
Cadiz	4, 220		
New Orleans	1, 308		

NOTE.—The distances are measured by customary routes most convenient for sailing ships and slow freight steamers.

APPENDIX A.

THE NICARAGUA CANAL--ITS DESIGN, FINAL LOCATION, AND WORK ACCOMPLISHED.

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The idea of establishing a waterway across the American isthmus dates back from the beginning of the sixteenth century, when the early navigators, perceiving the narrow neck of land separating the two oceans, were forcibly impressed by the advantages to be derived by cutting a canal through it. The Isthmus of Panama, being the narrowest part of that strip of land, and Nicaragua, on account of the evident natural facilities presented by the lake and its outlet, the river San Juan, have always been the main points of attraction as possessing the most favorable features for doing the work, and as early as 1550 the Portuguese navigator Antonio Galvao proposed four routes; one of which was by way of Lake Nicaragua and the San Juan River, and another through the Isthmus of Panama. As the configuration of the isthmus became better known, the belief in the practicability of joining the two oceans by a canal gradually increased; but it was not until the beginning of the present century, when through the indorsement of Humboldt, who had studied the problem on the ground, and later on through the united efforts of the Central American Republics, that the question commenced to assume a well-defined shape. But, while these States and the Republic of New Granada were anxiously soliciting the cooperation of other nations and of capitalists in favor of the undertaking, no regular surveys had been made of any portion of the isthmus; the routes proposed and claimed to have been discovered being the result of imperfect reconnoissances or of the imagination. It was evident, moreover, that the work would require the expenditure of large sums of money; and, while it was universally admitted that the canal would be of great advantage to the world at large, it was not equally clear that the probable traffic seeking it would be sufficient to pay interest on the capital invested. But the gold discoveries following the acquisition of California by the United States, and the subsequent rapid development of the vast commercial and agricultural interests of the Territories lying on the Pacific slope, exerted a powerful influence in attracting attention to the commercial and political importance of the canal. What had until then been regarded as a humanitarian scheme or a geographical desideratum became a political and commercial necessity, and the attention of the American statesmen, capitalists, and scientists was at once directed to finding the most practical solution of the problem.

The idea of establishing a continuous water communication between the two oceans has been always recognized as the only means of satisfying all the requirements of commerce, but a satisfactory solution of all the unknown quantities entering into such a vast undertaking could not be reached without serious surveys of the isthmus, and these required time and the adjustment of political difficulties with other nations interested in the proposed work. In the mean time the Americans, anxious to meet the increasing demand for means of communication between the two oceans consequent to the rapid development of the Pacific coast, turned their attention to an overland route, and, having obtained a concession from the Republic of New Granada, in 1849 organized a company and intrusted the surveys for a railroad to Col. G. W. Hughes and J. C. Trautwine, well-known civil engineers. This was the first authentic survey made across the isthmus, and resulted in the construction of the Panama Railroad between 1850 and 1855.

In the meantime the Government of the United States, alive to the importance of the canal, had ordered a reconnaissance of the Isthmus of Tehuantepec, and, by diplomatic negotiations with Nicaragua, had encouraged and supported the organization of the Atlantic and Pacific Ship Canal Company, which had obtained from Nicaragua the right to build the canal, and, pending the completion of the work, to establish a transit between the Caribbean Sea and the Pacific Ocean, to facilitate the commerce between the two oceans, by way of the river San Juan and Lake Nicaragua.

This company intrusted the survey for a ship canal to Col. O. W. Childs, a conscientious and able engineer. He examined in 1850 several routes between Lake Nicaragua and the Pacific Ocean, and is entitled to credit for the discovery of the lowest depression in the Cordilleras between the Arctic Sea and Cape Horn. Through this divide, which he found to be 152 feet above sea level, he located a route for the canal extending from the mouth of the river Lajas, on the west shore of the lake, to the Port of Brito, or the Pacific, the main features of which have stood the test of many subsequent surveys and rectifications in that region, and have been incorporated in the plan of the final location of the canal across that country. Col. Childs's plan contemplated the use of the lake as the summit level, and of the valley of the river San Juan, its outlet, to its delta, through which he proposed to excavate a canal following the left bank of the river to Greytown. This survey was the first on the isthmus for a ship canal conforming to the requirements of engineering, and its accuracy has been fully confirmed by subsequent explorations.

Much might be said here to show the great interest evinced by the Government of the United States in the building of a canal, and to demonstrate the fact that the only thorough surveys made on the isthmus with the view of establishing the practicability and cost of the work have been done either by the Government directly or by American citizens under its auspices.

It is interesting and instructive to follow, step by step, the American explorations on the isthmus from Tehauntepec to the Gulf of Darien, but this paper deals with the proposed Nicaragua Canal, which is believed to be the only practicable route for connecting the two oceans by a ship canal. This conclusion is the result of forty years of exhaustive studies over the whole isthmus and of a valuable lesson so dearly taught by an unfortunate attempt to prove the practicability of building a canal by the expenditure of vast sums of money in useless excavations and wild schemes for removing insuperable natural obstacles prior to a thorough examination of the physical conditions.

The period from 1870 to 1876, during the administration of General Grant, was one of marked activity in the explorations of the isthmus, and it may be said that the question as to the route possessing the greatest advantages was settled in February, 1876.

The commission appointed by President Grant in 1872 to report upon the various plans submitted by the surveying parties consisted of General A. A. Humphreys, Chief of the United States Corps of Engineers; Mr. C. P. Patterson, Superintendent of the Coast Survey, and Commodore Daniel Ammen, Chief of the Bureau of Navigation of the Navy Department.

On February 6, 1876, the commission submitted its decision to the President of the United States, in which it was said: "After a long, careful, and minute study of the several surveys of the various routes across the continent, we unanimously report that the route known as the Nicaragua route possesses, both for the construction and maintenance of a canal, greater advantages and offers fewer difficulties from engineering, commercial, or economical points of view than any of the other routes shown to be practicable by surveys sufficiently in detail to enable a judgment to be formed of their relative merits, as will be briefly presented in the appended memoranda."

The routes considered by this commission were the Tehauntepec, the Nicaragua, the Panama, and the Atrato-Napipi. The surveys conducted by the Government of the United States at other points did not develop physical conditions favorable enough to justify a location sufficiently in detail to form an estimate of the cost, and the results of the explorations were examined by the commission only in so far as was necessary to show their impracticability or inferiority as compared to other routes.

The survey of the Nicaragua route by the United States Government was commenced in March, 1872, and continued until July, 1873. Eight different routes between the lake and the Pacific were carefully examined. The correctness of Childs's survey from the mouth of the river Lajas to Brito was carefully confirmed, and, while the low divide was a strong feature in favor of his location, the problem of properly draining the valley of the Rio Grande was not at the time satisfactorily solved, and the next best route, extending from the mouth of the small stream Del Medio at the lake north of Lajas to a point on Childs's line 9 miles west of the lake, and thence following Childs's line to Brito, was adopted and carefully located.

In this, as in all projects for a canal across Nicaragua, the lake was taken as the summit level, and in this location its mean level was assumed to be 107 feet above sea level. East of the lake slack-water navigation was secured in the river San Juan for a distance of 63 miles by the construction of four dams, the lower dam being below the confluence of the San Juan and San Carlos Rivers. Below that point the canal was proposed to be excavated for a distance of 41.9 miles on the right bank, and following the general direction of the river to the outlet, San Juanillo, where it turned almost directly to Greytown. Twenty-one locks, with an average lift of ten feet, were proposed; ten on the Atlantic and eleven on the Pacific slope. This project was a decided improvement on that proposed by Childs, but in its general outline the design did not differ very materially from his. Its main features were as follows:

Canal in excavation	61.74
Slack-water navigation in the River San Juan	63.02
Lake navigation	56.50
Total miles from ocean to ocean	181.26
Number of locks	21
Number of dams across the river San Juan	4

The total cost was estimated at $65,222,147.

The writer, who had been the chief engineer of the Government surveys, recognized the practicability of the canal by this route, but was not satisfied with the location. The Lajas line, with its low divide of 152 feet, had been reluctantly abandoned on account of difficulties in the drainage problem, and the Medio route, with 90 feet greater depth of cutting, had been adopted instead, thereby increasing the difficulties in construction and by several millions of dollars the cost of the work.

In the Eastern Division the frequent interruptions of the river navigation by the interposition of dams was not a desirable feature, and the sharp curves and too close proximity of the canal, in excavation to the river, in several places, should, if possible, be eliminated from the problem. There were, also, too many locks, which together with the long stretch of canal in excavation, would necessarily tend to retard navigation and restrict the capacity of the canal for traffic.

The Government surveys were intended to show the practicability of the canal, and that object had been fully attained in the comparatively short time devoted to the work, but it was quite evident that before the project was finally adopted as a commercial enterprise, important modifications should, and could, in my opinion, be introduced in the original designs. To what extent this has been accomplished will be shown in the description of the route finally located and adopted by the present Nicaragua Canal Construction Company. In 1876–'77, while surveying the delta of the San Juan and harbor of Greytown for the purpose of devising plans for the improvement of the navigation of the river and the restoration of the harbor, I had occasion to make extensive reconnoissances in a direct line connecting Greytown with the end of slackwater navigation in the San Juan River, my object being to find, if possible, a direct route joining those points, in lieu of the long and tortuous line following the bank of the river. These explorations, conducted from both ends of the desirable location, and in opposite directions, could not be completed within the time then at my disposal. There remained a gap of 4 or 5 miles yet to be examined, but, so far as carried out, the results of the explorations were extremely gratifying, with strong indications of physical conditions favorable to a satisfactory solution of the problem.

In 1880 I devoted my attention to a rectification of the Lajas location, and succeeded so far as to reduce the length of the route by 1½ miles; eliminate several curves and enlarge the radius of others; decrease the amount of excavation in the narrow valley of the Rio Grande, and, what was of the greatest importance, found a satisfactory solution of the drainage problem by diverting the waters of the Grande, above its confluence with the canal, through an artificial channel, and the rivers Juan Davila and Lajas into the lake, thus leaving the narrow valley of the stream free for the canal.

That much having been accomplished in the Western Division towards the contemplated improvement of the original location, a greater interest was naturally felt for a thorough rectification of the eastern section. In 1885 the Government of the United States, immediately after having completed a treaty with Nicaragua for the construction of the canal, directed me, at my own suggestion, to proceed to Nicaragua with a party of competent assistants and ascertain the practicability of introducing favorable modifications in the eastern section of the canal location. The results attained by this last examination, together with what had been previously secured west of the lake, were all calculated to attract the attention of engineers and capitalists, and the organization of the company chartered by the United States Congress and now building the canal, soon after followed. The results of this survey can be found in detail, in book form, in my report to the honorable Secretary of the Navy, dated November, 1885, and entitled "Report of the United States Nicaragua Surveying Party" (Ex. Doc. No. 99, Forty-ninth Congress, first session).

The company was well aware, however, that while these surveys were ample to prove the practicability of the canal, and sufficient in detail to arrive at an approximate cost of the work; yet they were only intended as a preliminary location, and more thorough studies, comprising the minutest details, were still wanted before actual construction could be commenced. Therefore the first work undertaken by the company, immediately after its organization, was to fit out and send to Nicaragua a numerous corps of competent engineers, with instructions to make a thorough relocation of the whole route and accessory works, so as to eliminate all doubtful elements and to arrive at an accurate estimate of the character, amount and cost of all the work required for the completion of a canal ample for the navigation of the largest ships afloat, and the passage of the maximum traffic likely to seek it.

Six land surveying parties, one hydrographic party, and two boring parties, have been for two years and a half making this verification, and although the axial distance of the land survey (exclusive of the lake and river) is less than 50 miles, the length of lines actually surveyed by transit and level, in cross-sectioning, location of locks, dams, embankments, railroads, flowage lines, drains, etc., is not less than 4,000 miles, or at the rate of 40 miles of actual instrumental survey for every mile of final location. The result of this laborious work has been a verification of the location of 1885 in its essential features, but with marked improvements in the details, and the final location of the route upon which the canal is now being constructed, and which I will proceed to describe in a concise form.

THE PROPOSED ROUTE.

San Juan del Norte (Greytown) on the Atlantic, and Brito on the Pacific, are the termini of the canal, the total distance from port to port being 169.448 miles, of which 26.783 miles will be excavated canal and 142.659 miles free navigation by Lake Nicaragua, the river San Juan, and through basins in the valley of the streams Deseado, San Francisco, and Tola. Lake Nicaragua is necessarily the summit level of the canal, and its elevation above mean sea level is taken at its mean at 110 feet. It will be connected with the Pacific by two sections of canal in excavation and the Tola basin, and with the Atlantic by slackwater navigation through the valley of the river San Juan, and a series of basins in the valleys of the San Francisco and Deseado, connected by short sections of canal, the sea level on each side being reached by three locks which have been located as near as possible to the extremities of the canal, viz, 3½ miles from Brito and 12¾ miles from Greytown, thereby giving a clean summit level of 153¼ miles in extent out of a total distance of 169½ miles, as stated above. For purposes of description the route has been divided into four divisions, viz, Eastern, San Francisco, Lake and River, and Western.

Eastern Division.

[From thei nner harbor of San Juan del Norte (Greytown) to the San Francisco Basin, 18.864 miles.]

The line selected and located starts from the inner harbor of San Juan del Norte and extends in a southwesterly direction for a distance of 9,297 miles to Lock No. 1, in the valley of the small stream Deseado, which descends from the high ridge separating the valley of the San Juanillo from that of the Caño San Francisco. Where the stream Deseado interferes with the course of the canal, it is to be diverted by artificial channels. These first 9.297 miles of canal will be at the level of the sea, forming practically a prolongation of the harbor of Greytown, the width proposed allowing ample room for the passage of vessels going in both directions. The excavation will be entirely through flat, alluvial deposits, as shown by the numerous borings taken along the whole line.

The first lock from this reach will have a lift of 30 feet, and the uniform dimensions of chamber adopted for all the locks, viz: 650 feet long and 70 feet wide. A suitable rise of ground for the site of the lock is met with in the lower valley of the Deseado. From the head gate of Lock No. 1, to Lock No. 2, the canal follows the valley of the Deseado, which is here partially flooded by the construction of four low embankments connecting the site of Lock No. 1 with the sides of the valley. In this manner the canal excavation, which here consists chiefly of stiff red clay underlying a thin stratum of loam, is much reduced, and the drainage economically and efficiently controlled by suitable weirs of maximum flood capacity.

Lock No. 2, located 1.258 miles above the head gate of Lock No. 1, has a lift of 31 feet and will rest on solid ground, a hill on the south side of the valley affording an excellent site for it.

Lock No. 3, with a lift of 45 feet, is located 12¾ miles from Greytown and 1.927 miles from the head gate of Lock No. 2. This section of the canal occupies the lower basin, made in the valley of the Deseado by the erection of a dam 38 feet high and 1,300 feet long across the stream, and two embankments of an aggregate length of 1,400 feet and about 20 feet high, on the top of the confining ridges. The only excavation needed through this basin is in cutting across three low hills of red clay.

At this point the valley of the Deseado is spanned by an embankment 70 feet high and 1,050 feet long, resting on two high hills, and the gaps on the ridge connecting this embankment with the sides of the valley are closed with small embankments aggregating 5,800 feet on the crest, with an average height of 20 feet to the level, 112 feet above sea level. By this means a basin 3.086 miles long is created in the valley of the stream in which a depth of from 30 feet to 70 feet is obtained, without excavation, for a distance of 2.598 miles. It is proposed to retain the water in this basin at an elevation of 106 feet above sea level; in other words, the summit level of the canal is carried across the "divide" and extended to Lock No. 3, or to within 12¾ miles of the Atlantic, and but 3½ miles from the sea level, which, as stated above, reaches 9¼ miles up from Greytown. The advantage of these two large reservoirs in close proximity to the locks need not be commented upon, and the facilities afforded as a "turnout" for ships in waiting and traveling in opposite directions can not be overestimated. The dam is proposed to be built of stone or what is termed "rock-fill," with earth backing, and will have a weir 600 feet long on the crest, and a fall of 45 feet for the discharge of the surplus water into the lower basin. This will be supplemented by another weir 800 feet long, located on the south side of the valley in a gap between the hills inclosing the upper basin, giving a total length of weir of 1,400 feet.

At the western extremity of this basin begins the Eastern Divide cut, connecting the valley of the Deseado with that of the Caño San Francisco. This cut is 2,917 miles long, has a maximum cut of 298 and average depth of 111.2 feet above the level of the water, the depth in the canal being 30 feet, and contains about 21 per cent. of the total excavation estimated for the whole canal.

The magnitude of this work grows less striking as we proceed to examine its importance as a factor in the solution of the problem, the local advantages for its execution, its permanency when finished, and the advantageous and economical disposition of the material to be excavated.

First.—It will be observed that this cut is almost in a direct line between Ochoa and Greytown, which are the two objective points of the canal; the former being the point at which it must, of necessity, leave the San Juan River, and the latter equally necessary as its terminus on the Atlantic.

Second.—It is the lowest point along the whole ridge which intervenes between these two points, and nearly equidistant from each.

Third.—It is also the narrowest pass, by several miles, of any other on the ridge, the valleys of the Deseado on one side and the San Francisco on the other, here penetrating it farther than elsewhere, thus allowing the greatest possible extension of their basins with the least excavation.

Besides the above there are several other important advantages connected with this particular pass entitled to much consideration.

First.—The material to be removed is in the main solid rock; therefore the volume of excavation is reduced to a minimum, and the cut, when made, will remain so forever without further expense.

Second.—The material is needed for the construction of the dam at Ochoa, for the embankments between Ochoa and Greytown, for the construction of the locks, for the breakwater at Greytown, and for pitching the sides of the canal, and the surplus can be dumped in the immediate vicinity.

Third.—The center of distribution is most conveniently located, and were not this material available, at the sole expense of transportation down grade, it would have to be obtained at considerable cost from quarries in the vicinity, as there is no rock easy of access between Ochoa and Greytown, except in this ridge.

Fourth.—The locality is one of the healthiest in Nicaragua, the drainage is perfect, and water abundant and excellent for domestic uses.

Fifth.—There is close at hand on both sides of the ridge an inexhaustible water power for the economical and convenient operation of all the machinery required to do the work.

Possessing, therefore, as it does, this truly marvelous coincidence of favorable circumstances, it would seem as though the very hand of nature had made this particular spot with the view of facilitating the execution of the greatest undertaking of this or any other age. With proper appliances and good management, so much of the work in the adjacent sections being dependent upon the material to be got from this cut, an even rate of progress can easily be maintained and the whole work be pushed to completion well within the six years estimated as the time for completing the canal.

San Francisco Division, 12.500 *miles.*

[From the western end of the Divide cut to the River San Juan at Ochoa.]

On the western slope of the divide, the canal follows the valley of the Limpio for 1.477 miles to the end of the cut. Before falling into the San Francisco basin it passes for .738 miles through a rolling country in the lower valley of the Limpio, the average depth of the cutting for this distance being 16 feet above the bottom of the canal.

Passing into the basin of the Caño San Francisco it follows the valleys of the Limpio and Chanchos to near the confluence of the latter with the San Francisco, and then up the valley of the last-named stream, skirting the hills on the west to a favorable pass in the hill range separating this valley from the swampy region called Florida Lake, extending towards Ochoa. The line of location follows this swamp to its western extremity, where it strikes the high rolling country intervening between this low region and the valley of the Machado, and following a tributary of the latter, it enters the River San Juan, 1,600 feet above the mouth of the Machado. The distance from the western end of the divide cut to the bank of the River San Juan is 12.500 miles, of which 7.481 miles are tangents and 5.019 miles comprised in eleven curves of from 4,000 to 11,459 feet radius. The hills surrounding the basin on the south do not form an unbroken range rising at all points above the level of the water, which, in this section also, is maintained at 106 feet above sea level. Eight gaps will have to be closed by embankments aggregating in length to 2,440 feet, measured on the valley floor, and 12,260 feet on the crest, the maximum depth being 60 feet below the level of the water in the basins.

In addition to the above, 59 smaller embankments, aggregating in length 18,280 feet on the crest, rising 6 feet above water level and varying in height from 1 to 50 feet, will be required from Ochoa to the main ridge of the divide. All embankments resting on the valley or swamp level are designed of rock fill and earth-backing, with three parallel rows of sheet piling between abutments.

The total length of basin secured by this plan is 11.267 miles from flowage line to flowage line, of which 8.697 miles are in water varying from 30 to 60 feet in depth. That is, of the 12.500 miles in the division, but 1.233 miles will be wholly, and 2.570 miles partly, in excavation. This is not, however, the only advantage gained by the creation of this basin. Without it the cut across the divide would be of such proportions as to make the route commercially impracticable, and the basin of the Deseado an impossibility. Not less important are the additional considerations of free navigation through a wide and deep basin, instead of a restricted excavated channel. In the former, vessels can travel at full speed, lie at anchor, or pass each other at all points, while in the latter, the position and speed of all ships must conform to rigid regulations.

Attention is also invited to another striking feature of this work, as compared with that close to the bank of the San Juan.

In a country subject to observed rainfalls of more than 6 inches in twenty-four hours, the problem of drainage involves a contest with forces of nature whose enormous destructive powers are a constant menace to engineering works, however careful and skillful their design and execution. And it is of the utmost importance, therefore, to reduce these forces to a minimum before the construction of works to withstand them.

The large territory embraced between the ridge confining the basin to the south and the "lower route," which term is used to designate the canal line formerly proposed, and which lies on the right bank of the San Juan River to Greytown, is, by the adoption of the "upper route," or that over which the canal is being built, entirely eliminated from the problem of drainage, leaving only that portion of the watershed north of the ridge, from the divide to the valley of the Machado, to be provided for. The area of this catchment basin is about 65 square miles.

It is proposed to build all embankments across the valleys in the disconnected portions of the ridge, of rock fill and earth backing, the crest to be 107 feet above sea level, and with the top and outer slope so shaped and paved with large stones as to admit the free flow of water over the surface without danger of injury, all other embankments to be 112 feet above sea level. All these embankments will be, in fact, so many waste weirs for the discharge of the surplus water at several points in the basin, with an aggregate length of 4,720 feet of spillway, and assuming that the embankments are perfectly tight, which will not be the case until several years after construction, and, therefore, that all the surplus water passes over the weirs, the maximum depth on the crest will not exceed 15 inches.

An extraordinary freshet in the San Juan above the dam would probably send some of the river water towards the basin, but it will be observed that the weirs in the basin alone are capable of discharging 90,200 cubic feet per second before the water reaches the top of the high embankments, and that, in such extreme cases, the basin would also be discharging through the divide cut, over the Deseado Dam and weirs, and, if need be, through the culverts of lock No. 3. As an additional precaution a guard gate is provided in the first cut east of the Machado, by which the waters of the river San Juan may be shut off from the basin. With these ample provisions the destruction of the smaller earth embankments by an overflow of the basin seems to be well guarded against.

Lake and River Division, 121.04 *Miles.*

[From Ochoa to Western Coast of Lake Nicaragua

This division extends from the western extremity of the San Francisco Division in the valley of the Machado to the entrance of the canal on the west shore of Lake Nicaragua. The total distance is 121.04 miles, divided as follows: navigation by the river San Juan, 64.54 miles; Lake Nicaragua, 56.5 miles. The section of the river from Ochoa to the Lake is to be made navigable by the construction of a dam at Ochoa, just below the Machado, maintaining the water at the summit level of 106 feet above sea level. It may be here explained that this elevation, hitherto treated as the summit level, is 4 feet below the lake, a fall of three-quarters of an inch to the mile being allowed for the slope necessary to discharge its waters, although for all the purposes of navigation that portion of the river is converted into an extension of the lake.

The dam is located between two steep hills, and its length of weir on the crest will be 1,250 feet, and abutments 650 feet. The average depth of the water in the river was, at the time of the survey, 8 feet, and the maximum depth, close to the southern abutment, 14 feet, the width between the banks being 950 feet. With a mean flow in the river of 20,000 cubic feet per second, the depth of water on the top of the weir will be about 3½ feet.

The dam is proposed to be built of rock fill and earth backing, in all respects similar to all the other large embankments and weirs already described. Its average height above the river bottom is 61 feet, its thickness at the top, 25 feet, and at the bottom, 500 feet. The core of the rock portion will be made of smaller stones, gravel, and refuse from the rock cuts, with three rows of sheet piling from abutment to abutment, and substantial concrete core walls from the ends of the sheet piling carried well into the abutment hills and up along the slope beyond the maximum flood level. The upper portion and long flat apron will be composed of stones of the largest dimensions that can be handled and arranged, the interstices being filled from behind with small stones, gravel, and earth dumped from suitable trestles.

By this dam, slack-water navigation in the River San Juan will be obtained in the whole distance from the Lake, in which, with the exception of the 28 miles above Toro Rapids, the navigable channel will be at no point less than 1,000 feet wide, with depths varying from 28 to 130 feet. Between the Lake and Toro Rapids rock blasting under water and dredging to an average depth of 4½ feet will be required at several places, amounting in all to 24 miles, most of the rock blasting occurring at Toro. The average depth of water, as raised by the dam, over the shallow places where deepening has been estimated for, is 23 feet, and the excavated channel is 125 feet at the bottom, the slopes varying with the character of the material.

A further important effect of the dam will be to raise the water from the River San Carlos to the level attained by the San Juan at their confluence above Ochoa, converting the valley of that stream into a spacious lake or port; and an integral part of the summit level and of the canal itself. Thousands of square miles of the territory of Costa Rica, now inaccessible by land or water, will thus become the richest portion of that Republic; and the sediment now being brought down by the rapid current of the river will then be deposited, for want of transporting power, at the mouths of the ravines and mountain torrents emptying into the basin. In fact, the area now scoured will be so much reduced that comparatively little material will be transported.

The confining ridge to the east of the valley of the San Carlos is a generally high range, extending in a nearly straight line from the south abutment of the Ochoa Dam, about S. 15° W. 7⅛ miles, to the foot of the high mountains of the interior. The length of the ridge, following its crooked crest-line, is about 10 miles. The hills forming the ridge do not form an unbroken range at all points higher than the level of the water, which is here also maintained at 106 feet above sea level. A number of short depressions will have to be closed by embankments, the tops of which will be at an elevation of 112 feet.

The total number of embankments necessary is twenty-one. Of these eight will be very small, the ridge being now above the water line but below 112 feet. Only two will reach the floor of the valley, having a depth of 48 feet. The remaining eleven have an average depth of 19 feet. The aggregate length of embankments on crest is 5,440 feet; on floor of valley 130 feet.

The embankments proposed will be entirely of clay, 15 feet wide on top, with slope of three to one on both sides.

It is proposed to build a large waste weir in the ridge about 2⅜ miles from the Ochoa Dam. This weir having its crest of 106 feet elevation, will discharge the flood waters of the San Carlos into the San Juan independently of and below the dam.

The valley of Cureño Creek runs directly from the site of the proposed weir to the San Juan, 5½ miles below Ochoa, hence no channel for the discharged waters need be provided.

In the east side of Lake Nicaragua, dredging in soft mud will be needed for a distance of about 14 miles to reach the depth of 30 feet, the average depth of the cut being 9.8 feet, and the proposed channel 150 feet wide at the bottom, with side slopes of three to one to the present bottom of the Lake.

From the end of this cut to within 1,400 feet of the west coast, at the entrance of the canal, the depth in the Lake varies from 30 to 150 feet. The excavation on the west side is estimated as rock. No borings were taken on this side of the Lake, but the indications on the shore and the result of the borings in the vicinity point to rock as predominating in the subaqueous excavation.

In view of the nature of the bottom and the prevailing winds on that coast of the Lake, it is deemed advisable, if not essential, to estimate for two crib piers or breakwaters at the entrance of the canal and extending into deep water a distance of 1,800 feet and 2,400 feet respectively. These piers will have the effect of arresting débris drifting along the coast by the action of the waves, insure smooth water at the entrance of the canal, and serve as guides to approaching vessels.

Western Division.

[From the Lake to Brito, 17.04 miles.]

This section of canal connects the Lake with the Pacific Ocean. It is 17.04 miles long from the shore of the Lake when at 102.5 feet above the sea level, the elevation at the time the surveys were made, to the port at Brito.

As the canal is now estimated for 11.44 miles of that distance will be wholly in excavation and 5.60 miles through a basin in the valleys of the rivers Grande and Tola.

In this basin from 30 to 70 feet of water can be had for a distance of 4.568 miles. The basin has an area of 4,000 acres, an extreme width of 12,500 feet, and an average of 5,500 feet. An alternative route has been located through the valleys proposed to be flooded for a canal in excavation should it be found more economical on account of the value of the land through which it passes. The only new feature of this division is the basin now introduced.

The first section begins at the mouth of the river Lajas, on the west shore of Lake Nicaragua, and follows the valley of that stream for a distance of 8,260 feet, in which the width of the canal is 120 feet at the bottom, and the side slopes one and one-half to one, both in rock and earth. The river Lajas here turns to the south, and it is proposed to divert it and make it discharge into the lake a short distance south of its present mouth. The canal continues on the same straight line, crosses a plain about three-quarters of a mile wide, and enters the valley of the Guiscoyal, a small tributary of the Lajas, and at 4.70 miles from the lake it crosses the highest elevation on the line between the lake and the Pacific. This point is 42 feet above high lake, or 152 feet above mean tide in the Pacific, and is situated in a valley about 2 miles wide, deserving special notice by reason of the fact that it is the lowest depression of the main ridge between the Atlantic and Pacific Oceans on the American continent.

After crossing this divide the line gradually descends at the rate of about 9 feet per mile, and in 1¾ miles farther it meets the Rio Grande, a mountain stream which drains an extensive area of the western slope of the Cordillera. The line of the canal follows the tortuous channel of the Grande, cutting across some of its sharp bends, or occupying a channel in short reaches. In 1¼ miles it frees itself from this contracted valley and cuts across a broad plain as it turns to the westward, and enters the basin of the Tola, 9 miles from the lake. The distance across the basin by the sailing line is 5.504 miles. This basin is formed by the construction of an embankment 1,800 feet long and 70 feet high, resting on two high hills at a place called La Flor. The method of construction of this embankment is in all respects similar to that adopted for the construction of the Ochoa Dam and embankments in the San Francisco Valley. The rock for the fill will be obtained from the excavations for Locks Nos. 4 and 5 in the north abutment, and the earth from the canal excavation east of the basin. The level of the lake will be extended through the divide cut and the basin to this dam, the top of which is established at 112 feet above sea level. Therefore, the lake will have to rise more than 2 feet above the proposed summit level before any water runs over the weir. With a length of weir of 1,300 feet and the lock culverts capable of discharging not less than 4,500 cubic feet per second, the level of the lake can be kept under control, even during extraordinary floods. Yet a guard gate is proposed in the section of canal between the lake and the "Divide" to shut off the water from the lake in case of necessity. No special provision has been made for the control of the rivers Grande and Tola, and none is deemed necessary. These streams will flow into the summit level, one between the lake and the Tola basin, and the other at the northern extremity of the basin. The waters will be distributed between the basin and the lake, or partly used for feeding the locks, and should both rivers be in flood while the water in the basin is below the crest of the weir, and therefore, most of the combined flow discharging into the lake, the current in the canal through its narrowest portion in the "Divide," will not exceed 2 miles an hour, which can do no harm to the rock cut, while in the larger portions of the canal the velocity would, of course, be proportionately less.

From the western end of the valley of Tola to Brito, the canal, after leaving Locks Nos. 4 and 5, cuts across a broad, flat country, with an inclination of about 9 feet per mile, to the port, a distance of 2.28 miles, in which the excavation does not exceed that required for the canal prism.

Three locks are proposed to overcome the difference of level between the summit and the Pacific. Locks Nos. 4 and 5 are located in the hill north of La Flor Dam; their chambers are 650 feet long and 70 feet wide, and the lifts 42½ feet in each. Lock No. 6, of the same dimensions of chamber, is situated 1.58 miles below, its lifts being 21 and 29 feet, respectively, at high and low tide. Between this lock and the port of Brito, a distance of 0.57 miles, the canal will be at the level of the sea, with an enlarged section, and may be regarded as an extension of the harbor, similar to that at the Greytown end of the route.

HARBOR OF GREYTOWN.

Thirty years ago this harbor had a comparatively narrow but safe entrance from the sea, with a deep and commodious inner bay, where the largest class of sea-going vessels could lie with perfect safety. To-day this bay is converted into a fresh-water lagoon, separated from the sea by a continuous sand strip, stretching across the old entrance. This sand bank is the work of the waves, which, striking the sandy coast at an angle varying with the direction of the wind, but always inside of the first quarter, drives the sand from east to west, to be deposited at the extreme western end of the hook, or east side of the entrance. This continuous operation caused the hook to advance until it struck the main coast on the west, thus completely inclosing the bay.

The plan for the restoration of the harbor is based on data gathered through many years of investigations, in which the nature and magnitude of the forces operating on the coast were carefully defined and considered. It became then an easy matter to create the means of opposing these forces, and the following plan has been adopted, and is now in process of execution.

It consists in the construction of a jetty, or breakwater, about 2,000 feet long, nearly normal to the shore of the sand strip separating the bay from the sea, and extending to the 6-fathom curve; then dredging from this latter depth offshore across the sand bank and in the inner bay.

The jetty is located to the windward of the proposed entrance channel, which it is intended to shelter from the sea and protect from the wash of the waves and the traveling sand of the coast. The shifting sand arrested by the pier will accumulate in the angle formed by the pier and coast until the deposit reaches the end of the breakwater, when there will be a tendency to shoal around the outer end and across the entrance. This can be again prevented by an extension of the pier, and the same process continued from time to time until the new coast line thus formed is perpendicular to the prevailing direction of the wind, when the shifting action of sea will be permanently arrested and the work of the waves will be confined to piling the sand on the beach.

The first section of the jetty extending from the shore to 15 feet of the water, is proposed to be built of creosoted timber, fascinage, and stone, and that portion in deep water to be of "pierre perdue" or rubble, the stone to be obtained from the "Divide Cut." The entrance channel is estimated to have a depth of 30 feet and a width of 500 feet at the bottom, and the inner basin is designed of sufficient dimensions to afford easy access to the canal and to accommodate a large number of vessels, its excavated area on the bottom being 206 acres, which, with the area of the enlarged section of the canal at sea level to Lock No. 1, gives a total area of 341 acres of water 28 feet deep, exclusive of slopes of three to one and the remaining portions of the inner bay not deepened, yet having in many places a depth of 20 feet, in which a large number of vessels of ordinary size can lie.

The first 700 feet of the pier have already been successfully built, and the results so far obtained fully confirm the expectations to be realized by the execution of the plan.

BRITO.

The recent surveys have greatly added to previous information as to the natural conditions of this locality, which, by reason of its being of necessity the terminus of the canal on the Pacific coast, has been spoken of as "the harbor," when, as remarked by Professor Mitchell, it is not even a roadstead. Yet the practicability of constructing a harbor at this point has not been disputed, the only difference of opinion being confined to details. The plan now proposed combines, as nearly as possible, the most economical form of construction with that best adapted to the physical conditions, and meets, it is believed, most effectually the objections raised against former designs.

The broad valley of the Rio Grande stretches to the coast at this point through a wide gap in the main range of hills extending along the Pacific coast. This valley, it is believed, formed once a considerable bay, but is now filled up for a distance of about 6,000 feet from the beach to about the level of high water. The proposed plan for the construction of the harbor consists, (1) in a breakwater 900 feet long, extending from a rocky promontory projecting from the beach at the western extremity of the range of hills, and, (2) another jetty, 830 feet long, normal to the beach nearly opposite the extremity of the one before mentioned. The proposed harbor will be partly in deep water confined by the jetties, but its main portion is proposed to be excavated in the alluvial valley, the whole forming a deep and broad basin penetrating 3,000 feet from the present shore line at high water and 3,900 feet from the entrance between the jetties. As an entension of the harbor, the canal itself is excavated at sea level with an enlarged prism for a distance of 3,000 feet farther inland where the tide lock has been located. It is believed that, with the basin as designed and the prolongation of the sea level through the canal, sufficient tranquility will be secured at the lock and in the harbor, but should this prove not to be the case, an enlargement of the main basin by dredging in soft material would be a question of but comparatively small expense.

The breakwaters, as estimated for, are of "pierre perdue," the material to be obtained from the rocky promontory or from the western "Divide Cut," the price allowed being on the latter basis. The harbor has an area of 95⅛ acres on the bottom or excavated portion, and with the sea level section of the canal the total area is 103⅞ acres of water, 30 feet deep, exclusive of the slopes of three to one.

MATERIALS FOR CONSTRUCTION.

The whole line of the canal is well supplied with timber, generally of excellent quality, though in some sections of the eastern division it has been deemed advisable to estimate for its use only on temporary works during construction, such as trestles, laborers' dwellings, etc., the sheet piling and most of the bearing piles being imported from the Southern States and creosoted when necessary. On the western division, however, the wood growing on ground less moist is of a very superior quality, and it is proposed to use it for all purposes, its durability having been amply proved in every class of construction throughout the country.

The rock proposed to be used for the dams, weirs, and breakwaters will be got from the divide cuts, which consist chiefly of basalt and various descriptions of trap of excellent quality for the purpose.

Lime of the best quality is obtainable in the western division at many places, and the numerous specimens of work on which it has been used have stood the test of many generations and are to-day in a state of perfect preservation, but it is calculated to supplement this supply with imported cement, which will be used largely in the form of concrete in the construction of locks, etc., clean sharp sand being found in abundance in the beds of most of the streams in the vicinity of the canal.

DIMENSIONS AND CAPACITY OF THE CANAL.

In establishing the dimensions of the canal it has been my purpose to profit by the experience at Suez, where a yearly traffic of 6,000,000 tons could not be carried through without serious delays to navigation. The reduction in the length of excavated canal accomplished by the last location in Nicaragua, through the substitution of free navigation in deep and broad basins for a restricted channel, gives additional facilities for the construction of a waterway capable of accommodating not less than 12,000 vessels, with a net tonnage of 20,000,000 a year, at but a small increased cost as compared with the advantages secured, both for the commerce of the world and the economical administration of the enterprise. In fact, the immediate and prospective benefits obtained by the enlargement, in the increased facilities for passing vessels, and a considerable decrease in the cost of maintenance and preservation of the work, fully justify, it is believed, the additional expense in the original cost. It will be seen on examination of the subjoined table that, of the 169.448 miles, the total length of the canal from the Atlantic to the Pacific, 121.04 miles is unimpeded navigation in the river San Juan and in Lake Nicaragua, and 21.619 miles through basins, making a total distance of 142.659 miles in which ships can travel with little or no restriction as to speed. Of the remaining 26.789 miles, 0.759 is taken up by the six locks, leaving but 26.030 miles of canal actually in excavation. Of this latter distance 18.189 miles are of canal large enough for vessels traveling in opposite directions to pass each other, the sectional area being in excess of the largest area of the Suez Canal. The two sections of canal with contracted prisms are in the eastern and western divide cuts; the first is 2.917 miles and the other 4.924 miles in length, and located as they are almost at the extreme ends of the summit level and in close proximity to the upper locks, it is believed that the slight additional facilities to navigation secured by enlarging the dimensions of the canal in these heavy rock cuts and the inconsiderable gain in the time of transit would not compensate for the larger outlay necessary.

Table showing the dimensions of the several sections of the proposed canal.

Section of canal.	Length.	Width.		Mean depth.	Area of prism.
		Top.	Bottom.		
	Miles.	*Feet.*	*Feet.*	*Feet.*	*Sq. feet.*
Greytown to Lock No. 1	9.297	288	120	28	5,712
Lock No. 1 to Lock No. 2, canal	1.258	210	120	30	4,950
Lock No. 2 to Lock No. 3, canal	1.650	210	120	30	4,950
Lock No. 2 to Lock No. 3, basin	1.762	....	....	30	....
Lock No. 3 to western end of eastern divide cut, canal	2.917	80	80	30	2,400
Lock No. 3 to western end of eastern divide cut, Deseado Basin	3.086	....	....	45	....
Western end of divide cut to Ochoa, canal	1.233	184	80	30	3,673
Western end of divide cut to Ochoa, San Francisco Basin	11.267	....	....	40	....
River San Juan to Toro Rapids	37.040	....	....	52	....
River San Juan, where dredging is needed	27.500	....	125	28	....
Lake Nicaragua	56.500	....	150	50	....
Lake to western divide cut, canal	1.565	210	120	30	4,950
Western divide cut, canal	4.924	80	80	30	2,400
Divide cut to east end of Tola Basin, canal	2.519	184	80	30	3,673
East end of Tola Basin to Lock No. 4, basin	5.504	....	....	50	....
Lock No, 5 to Lock No. 6, canal	1.582	184	80	35	3,673
Lock No. 6 to harbor of Brito, canal	.570	288	120	28	5,612

RECAPITULATION.

	Miles.
Canal excavation, east side	14.870
Canal excavation, west side	11.160
Six locks, both sides	.759
Canal in excavation	26.789
Deseado Basins	4.848
San Francisco Basin	11.267
Tola Basin	5.504
Length of basins	21.619
River San Juan	64.540
Lake Nicaragua	56.500
Natural waterways	121.040
From Atlantic to Pacific (length of canal)	169.448

In the lake and in the greater part of the River San Juan vessels can travel with unrestricted speed, and in some sections of the river and in the basins, although the channel is at almost all points deep and of considerable width, yet the speed will be somewhat checked by reason of the curves.

Official reports show that, in the Suez Canal, steamers of 4,400 tons can travel at an average speed of 6 statute miles per hour, and that smaller vessels travel through the canal at the rate of from 6 to 8 miles an hour. On this basis the following estimate of the time of transit has been prepared:

Estimated time of through transit by steamer.

	H.	M.
26.030 miles of canal, at 5 miles an hour	5	12
21.619 miles in the basins, at 7 miles an hour	3	05
64.540 miles in River San Juan, at 8 miles an hour	8	04
56.500 miles in Lake Nicaragua, at 10 miles an hour	5	39
6 lockages, at 45 minutes each	4	30
Allow for detentions in narrow cuts	1	30
Total time of transit	28	00

The traffic of the canal will be limited by the time required for a vessel to pass a lock and on a basis of 45 minutes and that but one vessel will pass in each lockage, the number of vessels that can pass through the canal in one day will be 32, or in one year 11,680, which, at the average tonnage of vessels going through the Suez Canal, will give 20,440,000 tons per year. This estimate is on the assumption that the traffic will not be stopped during the night, for, with abundant water power at the locks and at the basins the whole canal can be economically illuminated by electricity, and, with beacons and range lights in the lake and river, there seems to be no good reason why vessels should not travel day and night with perfect safety, and the outlay necessary for the illumination has consequently been included in the estimate.

WATER SUPPLY.

Lake Nicaragua has a surface area of about 2,600 square miles and a watershed of not less than 8,000 square miles. Gauges at its outlet, the River San Juan, at its lowest stage between the Lake and Toro Rapids, showed a minimum flow of 11,390 cubic feet per second. Colonel Childs estimated the discharge with full lake in the wet season at 18,059 cubic feet per second, which gives a mean flow of 14,724 cubic feet per second, or 1,272,530,600 cubic feet per day.

Water required for lockage.

	Cubic feet.
Water required for one lockage:	
On the east side	2,047,500
On the west side	1,933,750
On both sides	3,981,250
Water required for thirty-two lockages per day	127,400,000

This gives a daily excess for the lake supply *only* of 1,144,753,600 cubic feet.

To the latter amount must be added the flow of the several tributaries of the San Juan River between the lake and the Ochoa Dam, and also the tributaries of the basins forming part of the summit level, which would fully compensate for leakage and evaporation.

It is expected that considerable leakage will take place at the rock-fill dams and embankments before they consolidate and become tight, but this may well be accepted as a desirable condition to aid in gradually disposing of the surplus water without a large discharge over the weirs.

The above statement shows that the lake discharge is about ten times larger than the maximum amount needed for the canal, and it may be safely estimated that for many years after the canal is opened for traffic, the surplus, from that source alone, will be double that amount, while at the confluence of the rivers San Juan and San Carlos, above the Ochoa Dam, the excess may even reach forty times the quantity needed for the canal. It is evident, therefore, that as long as the summit level can be maintained at the required elevation, the leakage through the rock-fills, acting as safety valves, may be regarded as an element of security rather than one of danger, especially as the tightening of the dam may be regulated by depositing suitable material on the upstream side, or by dumping more stone on the lower slopes or on the crest, so as to preserve the desired elevation of the surface of the water.

A detailed estimate of the cost of the canal is foreign to the nature of this paper, but it may be proper to state that the probable total cost has been arrived at through careful computations based upon the data obtained by the last location and numerous boring along the whole route.

The eastern divide cut, less than 3 miles in length, is represented in the estimate with 7,000,230 cubic yards of rock in place, and 22 per cent. of the cost of the whole canal. Reference has already been made, in describing the Eastern Division, to the existing facilities for doing the work and the several purposes to which the material to be removed can be economically applied in the construction of the canal. In the Western Division the excavation in rock through the divide cut is estimated at 5,696,507 cubic yards, distributed over a distance of 9 miles, in which the deepest portion of the excavation is but 42 feet above the surface of the water. There are ample facilities for the deposit of the waste material not needed for the construction of the breakwaters, the locks, the embankments, the dam, etc.

Of the 26.789 miles of canal in excavation, more than 12 miles will be done by dredging at the level of the sea, the material to be deposited directly on both sides of the canal prism.

A railroad has been estimated for between Greytown harbor and the river San Juan above the Ochoa Dam, and on the Western Division between the lake and the Pacific, which, together with the lake and river and the smaller streams penetrating the valleys of the Deseado and San Francisco, will afford easy and economical communication along the whole route.

It is admitted that the cost of this work will be greater than that of similar work located in a well-developed country. A large percentage of the increased cost is chargeable to the transportation of machine tools, and to the difficulty of obtaining and providing for the workmen, the country from Greytown to the lake being uninhabited and covered with a dense forest, and intercepted by extensive swamps and ridges of steep hills; and that between the lake and the Pacific but sparsely populated. The erection of houses for the protection of property and the accommodation of employés will also be a necessary item of considerable expense, but the country is exceptionally healthy, and these structures need not be either substantial in character or expensive. They need be, as a rule, but temporary sheds built with material gathered along the line of the canal, at but little more cost than the labor of handling it. Yet much delay and expense will be found unavoidable in the preliminary preparations for commencing the work of excavation.

Another contingency which may cause a marked increase in the cost of the work is the physical inability of the imported workmen to perform the ordinary labor, as compared with that accomplished in a more temperate climate. The laboring classes of Nicaragua, when under proper control, are capable of an activity and endurance under great fatigue and exposure to the elements scarcely equalled in any other country, and with no apparent injury to health; yet the same capabilities can not be expected in unacclimated foreigners accustomed to different conditions of life. It is believed that not less than 6,000 excellent laborers can be obtained from the Central American States, and that with a judicious management all the help needed can be had from the Gulf States in this country where the climatic conditions are in many respects similar to those prevailing over a large portion of the canal route. The number of skilled laborers employed will be comparatively small. On the west side of the lake, where the greater number of laborers will be employed, the climate is not excelled for salubrity by any other portion of Central America, and in that portion of the eastern section from Ochoa to Greytown, which is the only locality where trouble from climatic causes might be expected, the unexceptional good health enjoyed by the employés of the company during more than two years of constant exposure to the influence of the climate, while undergoing all kinds of hardships and privations, seems to be an evident demonstration that no apprehension need be entertained as to the climate. It will be observed that in this section the work is divided into two large classes, viz: the divide cut and dredging. The first is located in the most elevated and healthy portion of the line, and in the second the number of employés is reduced to a minimum, as manual labor is almost entirely excluded. The small force necessary to handle and care for the machinery will be either housed on the dredges or in quarters in the divide where, with the purest of waters from the mountain streams and the cool trades constantly sweeping in from the sea, the slightest sanitary regulations will insure perfect health at all times.

It is believed that with an intelligent and businesslike management the canal can be completed in six years for the work of actual construction, and one year in making the necessary preparations to commence active operations, and that the total cost will not exceed $90,000,000, exclusive of banking commissions, interest during construction, and other expenses not included in the engineer's estimate.

WORK ACCOMPLISHED.

The first expedition for construction left New York on the 25th of May, 1889, and on the 3d of June landed at the proposed entrance to the canal, near Greytown, on a sandy, uninhabited coast, without harbor or shelter from the elements, with no means of communication along the line of the canal except through tortuous and much-obstructed streams, some of which could not float a loaded canoe, and depending altogether on a base of supplies for construction materials and subsistence 2,000 miles distant, with only one line of steamers touching on that coast, and two weeks distant from the nearest telegraph station. The first work of the pioneers of the great enterprise was, necessarily, one of self preservation. Rude temporary shelters had to be improvised for the protection of men and stores, while more permanent buildings could be erected; means of transportation along the route of the canal through deep and extensive swamps and virgin forests had to be provided for, and telegraphic communication to the nearest station (more than 100 miles from the coast) and connecting the various camps about to be established with the base of operations, was felt from the start to be a necessary adjunct to prosecuting the work. Under these conditions, aggravated by an insufficient supply of an inferior class of labor, the first operations were difficult, tedious, and expensive, and it was not until the month of October following that the preliminary organization of the various departments had been completed, and the ordinary work of construction could be said to have commenced.

The opening of an entrance into what used to be the Bay of Greytown, was recognized from the start to be an indispensable requisite in the prosecution of the work. Ships now anchor about 2 miles off shore, and machinery and other supplies are brought ashore in lighters, through a shifting entrance and dangerous bar, with a variable depth, never exceeding 6 feet. This method of landing supplies involves considerable risk and expense, and is altogether inadequate for the discharge of the heavy machinery. The company, therefore, has spared no effort in obtaining an entrance from the sea into the bay, and the construction of the breakwater was one of the first works undertaken by the company, and pushed ahead with all possible dispatch. This pier is now about 700 feet long, its outer end being in 12 feet of water, and so far has fulfilled, even beyond expectations, all that was expected to be accomplished by it. It affords already sufficient protection to the dredges excavating the channel, and the company has already made a contract for the dredging of the entrance and inner bay to a depth of 20 feet. Some of the dredges are now in Nicaragua and others are in process of construction and will leave soon for Greytown. It is expected, therefore, that within the next five months vessels drawing 15 or 20 feet may be able to enter the bay and discharge their freight directly on the wharves of the company.

Heavy machinery suitable for the work can then be safely landed, the work of preparation may be said to have been completed, and active operations can be undertaken along the whole route.

While prosecuting the harbor work the company has also established permanent quarters, erected large storehouses, hospitals, dwellings, shops, and other buildings. It has accumulated the necessary material for the construction of an aqueduct 13 miles in length (work on which is now actively pushed), which is to supply Greytown, the works on the eastern section of the canal, the harbor, and the company's headquarters, with fresh water from the mountains. It has erected wharves and warehouses for the receipt and storage of supplies. Parts of the San Juanillo, Deseado, San Francisco, and other streams, have been cleared of obstructions and made navigable for small craft, and several miles of the route of the canal, between the harbor and the Eastern Divide, have been grubbed and cleared and made ready for dredging. The company has built about 10 miles of broad gauge railroad and about 70 miles of telegraph and telephone lines, and has landed at Greytown large quantities of machinery, tools, lumber, piles, creosoted timber, boats, steam tugs and launches, lighters, pile drivers, and other materials and equipment necessary for the harbor and canal work. Large quantities of railroad supplies, locomotives, steam excavators, are now at Greytown, and a contract has been let for the construction of 17 miles of railroad from Greytown to the Eastern Divide cut, work on which has already commenced, and, in short, it may be safely said that the whole work is being pushed forward as rapidly as the circumstances and condition of the country permit.

A. G. Menocal,
Chief Engineer.

APPENDIX B.

SPECIAL REPORT ON DATA RELATING TO THE MARITIME CANAL OF NICARAGUA AND THE REGIONS TRIBUTARY THERETO.

[By CHARLES T. HARVEY, *Civil Engineer.*]

THE MARITIME CANAL COMPANY OF NICARAGUA,
Secretary's Office, 44 *Wall Street, December* 30, 1889.

The undersigned has been instructed to cause the following correspondence and report to be printed for the general information of the friends and stockholders of the above-named enterprise.

Special attention is called to the fact that the locks of the Lake Superior Ship Canal (of which the dimensions most nearly coincide with those proposed for the Nicaragua Canal,) have been in constant use for one-third of a century without cessation for a single day from accidents or for repairs during seasons of navigation.

This precedent is deemed by the company a sufficient indication that like results are certain in this enterprise, where the latest-improved lock appliances and safeguards will be provided from the outset, and where more favorable climatic conditions exist.

The fact that the Lake Superior Canal was built within the estimates of both time and cost, under less favorable conditions in many respects than attach to the construction work of this company, will doubtless have weight in the minds of those who in such matters are influenced by precedents.

The statistics of the growth and relative economy of the water way traffic of the section of this continent tributary to the Lake Superior Ship Lock Canal, are deemed worthy of especial attention.

The conclusions set forth in Mr. Harvey's report, illustrated by the accompanying maps, relating to the territory on this continent, from which commerce will seek the Nicaragua Canal as the most economical route, suggest new commercial conditions and results, deemed especially interesting to those having, or contemplating, investments in connection with this interoceanic and international water way.

THOMAS B. ATKINS,
Secretary Maritime Canal Company of Nicaragua.

THE MARITIME CANAL COMPANY OF NICARAGUA,
President's Office, 44 *Wall Street, New York, May* 15, 1889.

DEAR SIR: The fact that you occupied the positions of both business manager and constructing engineer of the greatest ship canal operated with locks at the time of its completion, and which has held the first place as to tonnage traffic up to the present time (outranking the Suez Tide-Level Canal in monthly volume of business during open season on the Western Lakes), and that you were honored with a vote of thanks by the Constructing Company for your ability displayed in prosecuting the canal work under your charge to completion, led the Nicaragua Canal Construction Company to select you as a member of the advisory board of engineers, which has lately concluded its revision of the estimates of Chief Engineer Menocal, as based upon the surveys made and data ascertained by the engineering corps under his directions.

Considering your former experience a valuable guide in such undertakings, and that your recent inspection of the maps, profiles, plans, and general data of this enterprise will enable you to state the main points connected with its feasibility and future traffic development in the light of established precedents coming under your personal observation, and in a manner which will no doubt prove worthy of special attention, I request you to favor me with your views and suggestions from the standpoint of a constructor of ship-lock canal work and manager of such water-way interests.

Yours, very respectfully,

HIRAM HITCHCOCK,
President Maritime Canal Company.

CHAS. T. HARVEY, ESQ.,
Civil Engineer, New York City.

NEW YORK CITY, *May* 20, 1889.

DEAR SIR: Your communication of the 15th instant has been received and duly considered. Prior engagements for the ensuing season will prevent my giving immediate attention to the subject to which you refer, but when otherwise disengaged I will endeavor to comply with your wishes.

I am at present planning to visit, during the coming summer, the ship canal at the outlet of Lake Superior, the subject of my former labors, and if that plan is realized, I will allot a portion of my time while there to formulating a statement of facts, past and present, connected with that water way, with a view to its bearing upon the results to be anticipated at the completion of the Nicaragua Ship Canal.

The extended examination of the construction data of the noble enterprise which you represent, made by me early in the present year, has led to the formation of opinions which, with due allowance for time necessarily occupied by other and prior professional engagements, can be placed at your service after my return to the city. Meanwhile you may not hear from me again until I reach the outlet of that matchless inland sea and the adjacent region where I was a pioneer in promoting the development of its then latent, but now famous, commercial resources.

I remain, very respectfully, yours,

CHARLES T. HARVEY.

HIRAM HITCHCOCK, Esq.,
President Maritime Canal Company.

INTERNATIONAL HOTEL,
Sault Ste. Marie, Ont., August 20, 1889.

DEAR SIR: Referring to my letter to you of May 20, 1889, I have now to say that circumstances have favored the plan I then entertained of revisiting this locality.

If any persons have the impression that ship canals have been superseded in commercial importance by the march of modern improvements in other forms of transit, a visit of inspection to this point (where is located the greatest development of lock canals to be found in the world) will quickly dispel such an illusion. From the windows of the hotel where these lines are written my eyes can rest upon enlargements of canal capacity, now being prosecuted upon both banks of the Falls of the St. Mary's River, the outlet of this greatest of inland seas, by two of the most enterprising nations of the world. The workmen employed in these respective operations are under separate nationalities, although less than one mile apart. And yet, with only the present facilities, more tonnage is being locked through the operating canal on the southern side of the river in seven months (navigation in this region being closed by ice, on the average, from December 1 to May 1 in each year), than is expected to pass through the Suez Canal during the present calendar year. I have myself seen, during one morning of this week, 15 steamers (some of 3,000 tons burden), clustered together as passed, passing, or waiting to pass the locks; and within the space of one hour all had disappeared upon their respective voyages.

The annexed view is from a photograph recently taken of a fleet of steam and sail vessels (the latter mostly masted barges, regularly towed between ports by consort steamers) awaiting their turn to pass through the lock of the United States Ship Canal at the entrance to Lake Superior.

Comparing this with the time when, in 1853, I wheeled out the first barrowload of excavation for the original ship canal at this point, the change seems almost incredible. Then a tram railway operated by a few horses sufficed to transfer around the falls all commodities to and from Lake Superior.

This, to my mind, is but an appropriate indication of the growth of the commerce which waits upon the opening of the Nicaragua interoceanic water way to crowd its utmost capacity.

Thus far, by way of introduction, to a report [part first] upon the data respecting water-way developments in this region, the preparation of which I have already commenced.

Very respectfully, yours,

CHARLES T. HARVEY.

HIRAM HITCHCOCK, Esq.,
President Maritime Canal Company, 44 *Wall St.*, New York City.

PART FIRST.

DATA RELATING TO THE SHIP-CANAL FACILITIES AND TRAFFIC OF THE LAKE SUPERIOR BASIN.

HISTORICAL.

In the last decade of the eighteenth century, a British fur-trading company constructed, on the Canadian side, a sluiceway for the passage of loaded bateaux around the Falls of the St. Mary's River, by a gradual incline to a lift-lock, about 40 x 9 feet in area, built of dressed timber, of which remains have recently been exhumed. Records are silent as to its further history, but it is believed to have been destroyed during the war of 1812-'14, when a military force from the United States burn every building in that vicinity.

In 1852 the Congress of the United States passed a law donating to the State of Michigan 750,000 acres of public land within its borders, to aid in building a ship canal around the Falls, committing the entire control of the work to the State, stipulating, however, that the canal should not be less than 10) feet in width, and 12 feet deep, with locks not less than 250 feet long and 50 feet wide.

Being myself at the Falls when this law was enacted, my own conviction of the importance of the work led me to immediately devote my time and energies to its promotion. In the line of this effort I attended the next session of the State legislature, and was selected by the committee having the matter in charge to draught the State law to govern the prosecution of the enterprise, and it was enacted substantially in the form in which I submitted it. Having made a tour of the lake region during the previous year, its latent resources so impressed me that, upon later attendance at the legislature, I strenuously advocated building the canal upon a still larger scale than the act of Congress called for, as sure to be needed in the coming years. Although the only person, so far as my memory recalls, who originally proposed an increase of the lock dimensions, my views were, after considerable hesitation, adopted by the legislators, and locks 350 feet long and 70 feet wide were (in the law) made obligatory by the State as a condition in any contract for the work.

Afterward, submitting a bid in behalf of Eastern capitalists, the contract was awarded to them, and I was at once appointed State's agent by the governor to designate the lands to be received in payment from the United States. In consideration of such selections as made by myself in the Upper Peninsula, and later by a co-land agent for the Lower Peninsula, my principals proposed to build the canal for the State, and upon the wise selection of the aforesaid lands their profits depended.

My next step was to apply to the legislature of New York for a special charter for a construction company, which the constitution of the State of Michigan did not permit, but which its legislature could (and did) recognize when created by another State. Having obtained the charter at Albany, New York City was next visited, where cash subscriptions were secured for the authorized capital stock of $1,000,000, and the same apportioned to capitalists, who constituted a remarkably influential and financially able body of stockholders.

Upon the organization of the corporation as the St. Mary's Falls Ship Canal Company I was appointed its general agent, with full executive powers for prosecuting the work, and proceeding to Detroit organized the first detachment of the working force, numbering about 400 men, chartered a steamer, and landed them at the "Soo" (the name under which the Falls, in abbreviation of the French name given it by the Jesuit pioneers of the seventeenth century, were known), June 2, 1853. On the 4th of the same month I formally broke ground, and the work commenced forthwith.

My supervisory duties included, unexpectedly to me, that of chief engineer, with the sole responsibility of directing the work, in all respects, during the closed or winter seasons. The most remarkable operation occurring in the engineering department during that period was the devising and constructing of a machine, operated by steam, which could deliver a blow of 10,000 pounds force per square inch, by which submarine rock excavation was carried on in midwinter in 2 fathoms of water, including nearly a half-fathom of ice.

When the emergency requiring such force was discovered, I was obliged to dispatch couriers over the icy wastes of frozen rivers and lakes to the Canadian settlements along the north shore of Georgian Bay to collect numbers of blacksmiths' bellows sufficient to furnish the blast for forging the main parts of this novel machine.

It proved a great success, and by it thousands of yards in area of solid rock were excavated rapidly and economically. While it was operating at the lake entrance I had the honor of personally opening the cofferdam sluice gates, which let the waters of Lake Superior flow permanently into the finished prism and locks of the ship canal *the 19th of April*, 1855.

The time between the commencement and completion of the work was twenty-two and one-half months, whereas the contract period allowed was twenty-four months. The capital allotted for the work was $1,000,000; but my account as construction agent was, in round numbers, less than $875,000. *Thus this canal was, both as to time and cost, completed within the original estimates.*

Probably no public work was ever constructed upon more honorable principles. In every case where, as engineer, I applied to the directors for permission to improve the work beyond the contract specifications, it was granted. The State engineer's plans were originally for lock-gates, worked with long beams, against which men were to brace their backs in opening or shutting. Before that detail was reached more excellent but costlier devices were substituted at the contractors' expense.

This canal had by far the largest locks then to be found in the world, and they have fulfilled their mission without defect or cessation for over a third of a century. Upon an examination made this week I could not find a single fissure in the lock walls or detect any deflection in them, nor in the miter sills or lock-chamber floors. That they would continue thus for ages, so far as the forces of nature are concerned, is unquestionable. The engineers of the United States Government have, however, now commenced operations to remove them, and to substitute a new lock of nearly quadruple capacity, as will be hereinafter noted.

In referring to them, General Poe, U. S. Army, in charge of the work, in his report of of December 29, 1886, uses the following language:

"They were magnificent constructions in their day, and would still be useful if the commerce had not entirely outgrown them."

It may be of interest to you to be assured that if the construction of the canal, of which you have charge, was under its present conditions the subject of choice for personal management, as against the canal at this point, with the surroundings under which its construction was undertaken, I should recommend yours as involving the least risk and administrative energy, to secure its completion within your engineering estimates as to both time and cost.

To meet any incredulity as to such conclusions, in view of the far greater operations required at Nicaragua, some of the obstacles overcome will, by way of contrast, be recalled.

This region was then more remote from the sources of labor supply and many prime materials than is yours at this time.

Thus in 1853 every one of the many thousand kegs of powder used was transported here from the States of Connecticut or Delaware on the Atlantic coast. Agents were required, en route to and from New York City, to hire immigrants and bring them here in gangs, paying all their expenses, and also to circumvent the emissaries of the various railroads then building in Illinois and Wisconsin, who came here surreptitiously to hire them to go elsewhere, as there was at that time a scarcity of labor throughout the West. The nearest machine shop was several hundred miles away, with no practical means of communication during five-twelfths of the year. The nearest telegraph station was at Detroit, 450 miles distant, and business letters in midwinter required six weeks to reach the Construction Company's New York office and return a reply.

On the other hand, all parts of your work will be in telegraphic communication with each other and with your New York office, while labor and supplies can be sent from the best markets directly and cheaply to your own landings and depots.

The conditions as to improvements in labor-saving machinery and explosives made available within the intervening years are almost incomparably in your favor.

In this case drilling was done mainly by hand—100 men then not equalling the work of ten men with present improved machinery. Then the only way to hasten the work was to increase the number of hands, and consequently at one time 2,000 men could here be seen at work within the space of 1 mile. The climate and sanitary conditions of your line of work must be considered as exceptionably favorable, in view of the equable mildness of the climate and for other reasons hereinafter stated under the caption of "climatic conditions," etc.

At this locality, during the severity of winter, 35 degrees below zero is frequently registered in the mornings of the short days, with only eight hours of sunlight

During the hours of such extremely low temperature one man was detailed to stand at the head of each of the runways for barrows, with orders when he saw a face frost-bitten to rub it with snow until circulation was restored without the barrow-man leaving the work. Epidemic cholera broke out during the second summer and carried to their graves about one-tenth of the working force.

When these facts are borne in mind it will be seen that a choice of your undertaking as the least difficult will not seem unreasonable. Experts have declared that the record of building a work of the dimensions and importance of the Lake Superior Ship Canal in the face of the obstacles indicated, and yet within the estimates as to both time and cost, has never been surpassed. Be that as it may, it is a pleasant conclusion of this historical notice to be able to say that, viewed as a financial venture, the canal proved a great success for its contractors, as the following instance will illustrate: An English capitalist, residing or having business connections in the Madeira Islands at that time, visited the works with introductory letters to myself, and, after personal observation, instructed his agent in New York to invest $100,000 in the Construction Company's stock. About twenty years later that agent's cashier informed me that he had remitted over $500,000 in sterling exchange as the proceeds of the sale of a part of that investor's quota of the selected lands, with a balance yet to follow.

The locks and canal as originally constructed continued uninterruptedly in use until the close of the season of 1886. Meanwhile the commerce of Lake Superior, in consequence of these canal facilities, increased so rapidly that the demand for enlargements was imperative—not alone from the State of Michigan, which controlled it, but also from such of the other States and the provinces of Canada as bordered upon its connecting lakes. Consequently the State of Michigan, on the 3d of March, 1881, passed an act transferring the canal to the United States Government, which by an act of Congress of the same year accepted it as a national canal—the most important public work within its broad domain. On the 1st of September of the aforesaid year the supplementary lock (for which Congress had made due appropriation) was added to the canal facilities.

Thus far in historical review.

It was my good fortune to meet here during the present month, General Casey, Chief of United States Engineers, having charge of all the national public works, also General Poe, U. S. Army, in charge of Government works in this district, together with Mr. E. S. Wheeler, civil engineer, United States, general superintendent of the canal.

By the courtesy of these distinguished officials, the opportunity was provided for an inspection by me of the governmental work of deepening the river about 20 miles below the canal, at a point known as the Middle Neebish Channel.

CHANNEL IMPROVEMENTS IN THE ST. MARY'S RIVER.

General Superintendent Wheeler accompanied me on the United States *steamer Despatch* on the 12th instant and afforded me all possible information concerning the Neebish Channel rock-excavating operations. A channel is there being cut through solid sandstone rock, from 10 to 15 feet thick, 300 feet in width, for a distance of over 2 miles.

Dredges were made capable of forcing their way through the less solid upper strata of the rock, but the use of explosives in all the strata was found to be cheaper. The chief interest centered upon a machine drill boat, having four steam drills working from one of its sides, boring 2½-inch-diameter holes about 6 feet apart, and 12 to 15 feet deep, into which 30-inch-long dynamite canisters were placed and exploded by electricity, without delaying the other drills at work alongside.

The perfection to which work of that kind has been brought is shown by the fact that the constructors now receive but $1.80 per cubic yard for the rock excavation, measured in place, although required to deposit the débris in a way to construct a sea wall or mole some 6 feet above water, 50 feet from and parallel to the ship channel, as a safeguard against transverse currents acting upon passing vessels. Superintendent Wheeler informed me that the same work, if let ten or twelve years ago, would have cost at least $4 per yard.

These and similar items of information have a direct bearing upon the plans and operations of your company, in prosecuting the deepening of the ship channel at its entrance into Lake Nicaragua and at various points along the San Juan River.

LOCK ENLARGEMENTS AND IMPROVEMENTS.

At the time of the completion of the original canal at this locality no vessels drawing over 8 feet of water could reach it from Lake Huron, owing to reefs and sand bars in the connecting river channels. Then the depth of 12 feet in the locks seemed ample. Not long after this was assured, the National Government entered upon the work of deepening and straightening the lake water courses to a minimum of 12 feet.

A decade later, the channel depth was generally increased to 16 feet, and the same is now being still further deepened to a minimum of 20 feet, under the supervision of Army officers detailed to that duty at the various points of operation.

Coincident with the attainment of the general canal depth of 16 feet, it became necessary to provide similar depth in the canal and locks, and accordingly a supplementary lock was built by the side of the original ones, the lift being made in a single chamber, as shown in the annexed photographic view recently obtained.

This is now the operating lock of the canal, being 515 feet long, 80 feet wide, decreased to 60 feet in width at the gates.

It has a depth of 17 feet over the miter sills, and a lift of 18 feet. The depth of the chamber is 39½ feet. At each end of the lock are placed outside guard gates of the same style as those in regular use, all being of the usual horizontal motion plan.

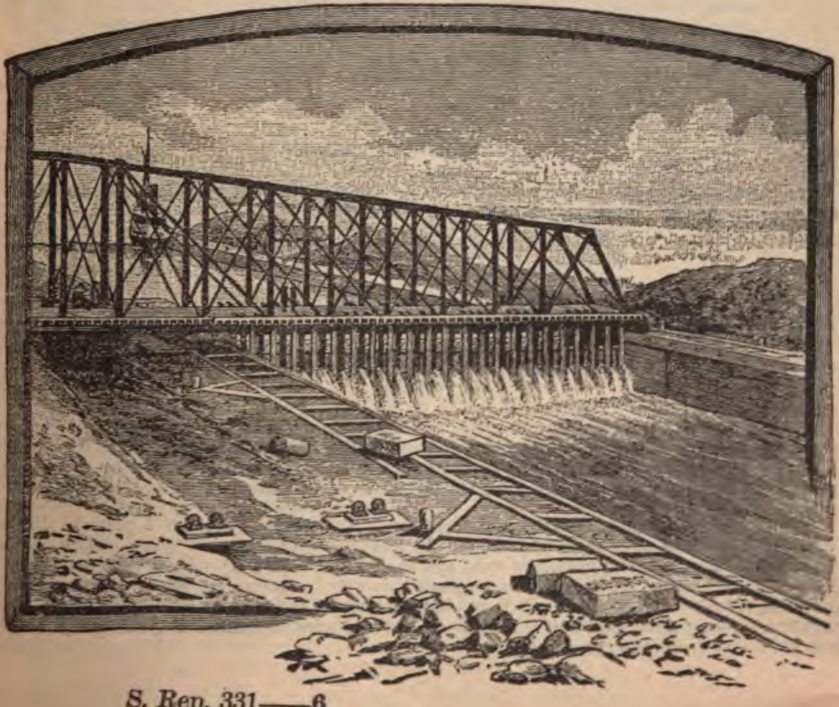
The inflow and discharge of the locks is provided for by two parallel conduits passing under the miter sills and lock floors; those for the inflow being 8 feet square, and having openings 2 feet square, occurring at regular intervals, under the whole length of the lock. This proves to be a perfect plan for the purpose, and is being copied, substantially, by the Canadian engineers.

The gates are operated by hydraulic power, in a simple but effective method, by which, in two minutes of time, the leaves are brought into reversed positions. Eleven minutes suffices for filling the lock, and eight minutes for its discharge. The lock and the canal are equipped with electric lights, and vessels are passing at all hours; the estimated capacity being 4 per hour, or 96 per diem. The greatest daily number passed to date was on June 14, 1887, when 87 were locked through. I recently witnessed a pleasing instance of international courtesy, when two Canadian Pacific Line steamers, of 2,000 tons each, were locked together through this United States canal, without toll or charge of any kind.

At the upper end of the canal is a novel arrangement of a guard gate, to be used in case of any serious displacement or damage to the operating lock gates; an accident which might convert the canal into the channel of a torrent, in which ordinary swing gates would not withstand the process of being closed.

This device may properly be termed a movable dam, and resembles, in appearance, an ordinary railway swing bridge, with the addition of a lower section moving in the canal prism. Its advantages are that it can be operated entirely on land, and, having slot openings, would not stop the current suddenly (being only partially shut, until each slot is separately closed), and thus this appliance would not invite the whole force of the current to crush the jambs or the gates.

The following wood cut will serve to indicate its form:



The possibility of this guard gate being called into requisition is not remote, for a heavily loaded steamship might easily surge against lock gates with force sufficient to carry them away singly, or through a series of lifts.*

The principle of the movable dam offers a reliable safeguard against such contingencies, and I can not too strongly recommend the adoption of the principle in its most improved form on the Atlantic and Pacific slopes of your water way, as of the highest importance. The credit of the above-mentioned device, I am informed, belongs mainly to Mr. Alfred Noble, formerly the assistant constructing engineer on this canal.

One feature of the new lock invites criticism. It is the drawing in of the chamber width at the gates, which is an unnecessary impairment of the capacity of the lock, as it prevents two vessels entering freely abreast. This feature is reported as being copied on the Canadian side, but in the latest and largest projected United States lock it is sensibly discarded altogether.

As before mentioned, the United States Government having engaged in the process of making all the lake-connecting channels of a minimum depth of 20 feet, new lock facilities commensurate with the increased draught became a necessary sequence. To provide these it was decided to remove the original locks already mentioned, and replace them by an enlarged lock with these unprecedented dimensions: 800 feet long, 100 feet wide in chamber and at gates, and having 18 feet lift, with 21 feet in depth over miter sills.

The gates are to be in two leaves of iron material, each of about 55 by 45 feet in area, and, as General Poe informs me, are estimated to weigh 124 tons for each leaf. Upon an intimation that I thought a plan involving less weight might be devised, he requested me to submit the same to him when I should have it fully prepared; this I intend to do in time for your company to have the benefit of his judgment as well as that of the Canadian canal engineers, who also desire to adopt improvements in this regard.

The Canadian Government having determined to build, at this point, a canal within its own territory, work has already commenced [under contracts to be completed in 1892], upon a canal 150 feet wide at bottom, with locks 600 feet long, 85 feet wide, and narrowed to 65 feet at gates, with 18½ feet over miter sills.

Assuming that both the United States and Canadian canal enlargements now in progress, will be in service at the commencement of 1895, the following growth of canal transit capacity in the first forty years of ship canal operations on this inland water course, will have been developed:

		Cubic feet.	Cubic feet.
1855.—Lockage.	350 by 70 by 16 (counting as one full lift)		392,000
1895.—Lockage.	515 by 80 by 16	659,200	
Lockage.	600 by 85 by 18½	943,500	
Lockage.	800 by 100 by 20	1,600,000	
			3,202,700

Increase, more than 8 for 1.

TRAFFIC DEVELOPMENT.

Surprising as the foregoing figures may be deemed, it will be seen that the traffic growth has a far larger ratio of increase. Thus:

	1855.	1888.
Registered tonnage	106,296	5,130,659
Tons freight, net (estimated)	30,000	*6,411,423

* Official.

The returns of the first three months of 1889 indicate that the freight tonnage will reach at least 7,500,000 tons, for the season. (Traffic to August 1, 3,426,051 tons.) The tonnage increase of the canal traffic (with a most liberal starting figure of registered, instead of traffic tonnage), is, therefore, in thirty-four years, over 60 to 1.

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* Since these lines were written, I have been informed by Chief Engineer Page, who has charge of all the Canadian canals, that such an occurrence has taken place more than once in his experience with the Welland Canal (extending between Lakes Erie and Ontario). A steamer, its engines "caught on center" when the engineer attempted to reverse their motion, caused a pair of gates to be disabled during the present season; and in a previous year an entire series of connecting lift gates were carried away from the same cause.

That the progress of annual development may be noted, the tables of yearly returns are to be annexed (see Addenda, page 45), by which it will be seen that there has been a steady advance from the beginning, and that at the same ratio of increase the traffic of 1895 will approximate 15,000,000 tons.

These astonishing results already attained have been realized, notwithstanding the fact that railways have been extended to all the principal points on both sides of this inland water course, from end to end, and also that Lake Michigan, through its Green Bay estuary, extends within 60 miles of Lake Superior at the point where the mineral belt commences, and there draws away several million tons (or more than one-half) of the iron-ore product along the South Shore region of Lake Superior,* the shipment of which passes east through the Straits of Mackinaw, or south through Green Bay and Lake Michigan, and, consequently, does not appear in the canal totals, as given above. (See map.)

THE CAUSE OF THIS REMARKABLE WATER-TRANSIT DEVELOPMENT.

The conditions causing and controlling this carrying trade are clearly set forth in official communications to the Chief of Engineers, U. S. Army, by General Poe, U. S. Army, dated United States Engineer's Office, Detroit, Mich., May 11, 1888.

It inclosed beside an admirable report by Mr. E. S. Wheeler, United States civil engineer, general superintendent of the Lake Superior Ship Canal. In it, as the result of a general inquiry among vessel owners, shippers, and consignees along this water course, the following data were established for the year 1887:

Average length of water transportation (Duluth to Buffalo), 811.4 miles.

Total of freight carried, 5,494,649 tons.

Total miles of conveyance for single ton, 4,458,544,804.

Total of freight charges, including terminal freight charges, $10,075,153.13.

Cost of water transit per ton per mile, 0.28 of a cent. Referring to the reports of the Bureau of Statistics of the United States, Mr. Wheeler found that the average freight charges of the railroad trunk lines for 1886 were 0.999 of a cent per mile, and the average cost as between land and water carriage was as 811 is to 183. It followed that the saving for the year to consumers of staples seeking a market through this canal was $34,557,140.

To this deduction General Poe adds the following remarks:

"It is not at all improbable that but for this water route, open for about seven months in 1887, the charges laid upon the freight carried would have amounted to $50,000,000. If this estimate is not exaggerated, and I think it is not, then the actual benefit to producer and consumer was fully $40,000,000 in that single year, divided among them in unknown quantities."

But Mr. Wheeler personally informs me that in pursuing the same line of inquiry for the year 1888 the existence of a decrease from prior water rates to that of 0.15 of a cent per ton per mile, or a reduction of about 44 per cent in that one year, was clearly established.

This would swell the total of annual saving to the shippers and the public, as resulting from the canal facilities, to the aggregate of nearly $60, 000, 000 upon the same basis of calculation as quoted on the authority of General Poe for the previous year.

Mr. Wheeler also predicts that the average of this year will reach still lower, and that the cause of these large reductions is to be found in the increasing use of much larger steamers, with freight-carrying capacities greater than ever before; the majority of these vessels now approximate 2,000 registered or 3,000 freight tons each, effecting by reason of such augmentation a great saving in expenses pro rata per ton as compared with the smaller craft of former years.

Here, then, is the primary cause and satisfactory explanation of the enormous developments of tonnage upon this inland water-transit line, namely, *in its being unapproachably cheaper than land carriage can ever be.*

THE BEARINGS OF THIS EXAMPLE UPON THE NICARAGUA ROUTE.

I. This is the only ship canal on the globe with lockage facilities upon a scale comparable with that proposed for the Nicaragua Ship Canal transit project, and it affords a realized example upon which to base calculations as to the future of that enterprise. If the tonnage of this canal route upon a water course composed of a cluster of inland lakes, paralleled through their entire length by railways, on both of their borders, and with competing adjacent water courses as shown, has actually increased from 1,567,741 tons of freight in 1881 to 6,411,423 in 1888, and presumably to 7,500,000 tons in 1889, what must be the traffic of the ship canal which bisects a hemisphere, saves 10,000 miles and fifty days of freight-steamer time between New York and San Francisco, and economizes proportionately in the time and the distance to and from innumerable other commercial centers?

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*At Escanaba, a city situated near the northern extremity of Green Bay, are docks with facilities for shipping ores on a more extensive scale than exist at any other port on the globe.

II. The same commercial forces which have raised the Lake Superior Canal traffic to the proportions stated wait upon the opening of the Nicaragua route to render a large section of this continent tributary to it. My views as to the extent of the same lead to the prediction which I will now venture to make, *that the "Lake Superior" and "Lake Nicaragua" lock-lift canals will divide between them the carrying trade to European destinations of the products of the eastern slope of the Rocky Mountains, north of latitude* 40°.

That the transatlantic traffic of the western slope will go via Lake Nicaragua no thinking mind will gainsay; but how many have considered how far eastward of the Rocky Mountains the competing line between these rival lock canals may come? Let them trace the one-hundredth meridian of longitude and notice how it bisects the great wheat-bearing belt of the Saskatchewan and Missouri Valleys in Manitoba and the Dakotas.

Let them suppose the case of the owner of 10,000 bushels of wheat stored in an elevator upon that line of longitude, north of the latitude of Chicago, in the latter part of November. If he would ship by the Lake Superior Canal he must wait five months for the "closed season" to pass. (The annexed view of the original upper lock gate at the "Soo" during the five months of "closed season" will serve to illustrate the meaning of that term.)

The shipper by the Lake Superior route must add to his investment charges for interest, for insurance, and possibly for taxes during nearly or quite one half of an entire year. After these drawbacks are met he must transport his grain by rail to Duluth; thence by steamer to Buffalo; thence by canal or rail to Montreal or New York; thence by steamer to Europe—this method of transportation involving three transfers en route. If, however, he loads his wheat on cars going West, they will deliver his grain at a Pacific seaboard, whence it will be carried by steamer through the Nicaragua Canal to Europe; a system of transit involving but one transfer en route, with no closed season whatever.

III. It is, from the foregoing premises, clearly deducible that the values of most of the exports, in at least thirteen States and Territories, besides several of the Canadian provinces, will be directly benefited by the water transit proposed by your enterprise; which will, in fact, constitute the small end of a funnel, the broad opening of which, reaching from Sitka to San Diego, extends eastward until it meets competing lines of water transit via Lake Superior or the Mississippi River.

In the accompanying map of this continent the different colors indicate the portions which in my judgment are to remain commercially tributary to its three main water-ways, viz: (1) The Lake Superior Canal and connecting lakes and canals. (Erie and Welland). (2) The Mississippi River and its tributaries. (3) The Nicaragua Canal. Also the remainder as connected with the seacoast.

Leaving this continent out of view, it appears that the currents of trade between this Central American route, in competition with those of the Suez tide-level canal will meet on the eastern coast of Asia, and that from the Straits of Sunda northward, trade and travel will gravitate strongly towards your route, moved thereto in no small degree by the attractiveness of the delightful scenery and climate of the Lake Nicaragua route, which will be in marked contrast with the intolerable heat and desolate surroundings which must always characterize a passage through the Red Sea and the Suez Canal, where no sailing ship is ever seen.

From these considerations the conclusion must be drawn that no artificial water way can be projected which will make such an extent of continental coast line and inland territory tributary to it as will be controlled by the Maritime Canal of Nicaragua, and that the data of the Lake Superior Ship Canal proves beyond peradventure that the Nicaragua Canal presents the most permanently profitable investment of its kind that can be offered to the public, because its position entitles it to be considered as the most important artificial water way on the globe, connecting, as it does, two great oceans at nearly the center of the habitable and consequently commercial zone, with all the traffic and revenues which that fact implies, in the light of the results furnished by the Lake Superior example.

NOTE.—Since the foregoing portion of this report was placed in type I have received from General Superintendent Wheeler an official statement of the traffic of the Lake Superior Canal for the year 1889, which is included in Addenda, page 45.

The only official report of the Suez Canal traffic for 1889 which I have as yet been able to obtain gives tables of the passages and receipts alone. But by comparison of the latter with the returns in tons of previous years, I am able to approximate closely, and find the result to be, respecting these several arteries of commerce:

	Number.	Tons freight.
Lake Superior Canal lockages (1889)	4, 684	7, 516, 022
Suez Canal passages (1889)	3, 425	6, 800, 854
	1, 259	709, 168

It thus appears that the Lake Superior Canal, in 1889, exceeded the Suez Canal in volume of business over 33 per cent. in voyages and 10 per cent. in freight, and consequently now ranks *first* as to commerce on the list of the world's artificial water ways.

ADDENDA.

[Referred to on page 43.]

Tabulated official returns of the commerce passing through the Lake Superior Canal from date of opening, in 1855, *to* 1889, *inclusive.*

Year.	Sailing vessels.	Steamers.	Total lockages.	Tonnage.		Year.	Sailing vessels.	Steamers.	Total lockages.	Tonnage.	
				Registered.	Actual freight.					Registered.	Actual freight.
1855.....	(*a*)	(*a*)	(*c*)	106, 296	(*c*)	1873....	1, 549	968	(*c*)	1, 204, 446	(*c*)
1856.....	(*a*)	(*a*)	(*c*)	101, 458	(*c*)	1874....	833	901	(*c*)	1, 070, 857	(*c*)
1857.....	(*a*)	(*a*)	(*c*)	180, 820	(*c*)	1875....	569	1, 464	(*c*)	1, 259, 534	(*c*)
1858.....	(*a*)	(*a*)	(*c*)	219, 819	(*c*)	1876....	684	1, 733	(*c*)	1, 541, 676	(*c*)
1859....	(*a*)	(*a*)	(*c*)	352, 642	(*c*)	1877...	1, 401	1, 050	(*c*)	1, 439, 216	(*c*)
1860 ...	(*a*)	(*a*)	(*c*)	403, 657	(*c*)	1878 ..	1, 091	1, 476	(*c*)	1, 667, 136	(*c*)
1861.....	(*a*)	(*a*)	(*c*)	276, 639	(*c*)	1879....	1, 403	1, 618	(*c*)	1, 677, 071	(*c*)
1862.....	(*a*)	(*a*)	(*c*)	359 612	(*c*)	1880....	1, 718	1, 735	(*c*)	1, 734, 890	(*c*)
1863.....	(*a*)	(*a*)	(*c*)	507, 434	(*c*)	1881....	1, 706	2, 117	2, 120	2, 092, 757	1, 567, 741
1864.....	1, 045	366	(*c*)	571, 438	(*c*)	1882 ..	1, 663	2, 739	2, 572	2, 468, 088	2, 029, 521
1865.....	602	395	(*c*)	409, 062	(*c*)	1883....	1, 458	2, 620	2, 351	2, 042, 259	2, 267, 105
1866. ...	555	453	(*c*)	458, 530	(*c*)	1884 ..	1, 709	3, 609	3, 074	2, 997, 837	2, 874, 557
1867.....	839	466	(*c*)	556, 899	(*c*)	1885....	1, 689	3, 354	2, 863	3, 035, 937	3, 256, 628
1868.....	817	338	(*c*)	432, 563	(*c*)	1886....	2, 534	4, 584	3, 593	4, 219, 397	4, 527, 759
1869. ...	939	399	(*c*)	524, 885	(*c*)	1887 ..	2, 562	5, 968	4, 165	4, 897, 598	5, 494, 649
1870.....	1, 397	431	(*c*)	690, 826	(*c*)	1888....	2, 009	5, 305	3, 845	5, 130, 659	6, 411, 423
1871.....	1, 064	573	(*c*)	752, 101	(*c*)	1889....	2, 635	6, 501	4, 684	7, 221, 935	7, 516, 022
1872....	1, 212	792	(*c*)	914, 735	(*c*)						

a No record kept until 1864.

c No record kept until June, 1881.

REMARKS.

The United States Government assumed control of operating the canal on June 9, 1881, when more full and accurate returns were instituted and maintained.

The west-bound freight amounted to about 33 per cent.

The Canadian freight, in 1888, amounted to about 6 per cent.

Cost, conveyance 5,494,649 tons of freight in 1887, estimated at $10,075,153, or, per ton per mile, 2.3 mills.

Cost, conveyance 6,411,423 tons of freight in 1888, estimated at $7,833,077, or, per ton per mile, 1.5 mills.

The consort masted barges are classed as sail vessels, but not used as such except in emergencies. No exclusively sail vessels are now regularly employed on that route.

The official estimate of expense for operating the canal for the year 1889 was $36,000.

PART SECOND.

OBSERVATIONS UPON THE ENVIRONMENT OF THE MARITIME CANAL OF NICARAGUA.

It may be well to state, incidentally, that in January, 1889, I received official notice that I had been named as one of the five engineers selected by the Construction Company to compose an advisory board of engineers to pass upon the surveys and the detailed estimates of cost of the proposed ship canal of Nicaragua, formulated by its distinguished chief engineer, A. G. Menocal, civil engineer, U. S. Navy. Also, that after my acceptance of such position, I was in attendance during parts of several months at meetings of the board in the city of New York, within which time special attention was given to the admirable series of maps and profiles which had been prepared by your engineering corps, as well as to the geological specimens and test-bore cores, of which a very complete collection was at hand for our consideration, together with all requisite explanatory information, supplied by Chief Engineer Menocal or his assistants of the surveying corps, Mr. R. E. Peary, civil engineer, U. S. Navy, and Ensign J. H. Maxwell, U. S. Navy, who attended meetings of the board for that purpose.

The reliable information thus at hand was sufficient to enable the board to arrive at determinate opinions in reference to the main features of the work, which, through our report, wherein we confined ourselves to the vital questiens of quantity and cost, have been made known as the collective conclusions of the examining engineers.

At a later period came the request contained in the introductory correspondence that I should, individually, enlarge the scope of observation, and consider and report upon circumstances and conditions other and beyond those to which the advisory board confined its inquiries. In complying with such suggestion, I desire at the outset to state that *my aim in preparing this report will be to explore fields of investigation not referred to by the able and distinguished experts who were my associates in the late advisory board.* With these preliminary remarks, I proceed to the consideration of certain fundamental features of this undertaking, as the basic conditions upon which to predicate reliable estimates, and also sustain the conclusions embodied in these pages.

FIRST.—*Local geological developments.*

Beginning at the deep-water line in the Atlantic basin, nearest the most northerly entrance to the San Juan River, the surveys prove that in securing 30 feet depth of water way, no rock formations will be encountered in the harbor basin or canal prism until the site of Lock No. 1 is reached. These most favorable geological conditions insure the practicability of excavating that portion of the Eastern section of the canal westward from Greytown Harbor, about 10 miles in length, by the aid of dredging machinery solely, where entire freedom from current agitation is assured, with convenient and ample dumping area under like conditions.

The excavation (as proven by the borings made by your surveying corps) will be either through alluvial silt, or sand, or clay formations together extending entirely across the delta of the Rio San Juan.

(Diagram A, attached, shows the composition of the canal prism between the ocean and the highlands of the San Juanillo range.)

The geological conditions of this section must consequently be regarded as extremely favorable for the rapid and economical construction of the work. There is also great economic significance in the fact that in these lowlands where, if at all, miasmatic attacks upon the working force may be anticipated, all excavation being effected by machinery, the operating employés will be sheltered from exposure to the sun and rain, and drilled in sanitary precautions—a course which will work wonders in maintaining health and vigor in the skilled labor required in the management of the all-powerful dredging appliances which modern ingenuity has supplied for the rapid and economical accomplishment of the extensive tide-level excavation required upon this section of the work.

In examining the next section, reaching from Lock 1 to the San Juan basin, above the Ochoa Dam, it is very gratifying to find that the first lock on the Atlantic slope will be placed upon solid rock foundations (see Diagram A), and that Locks 2 and 3 will also be located in rock ledges.

The importance of this beneficial feature, insuring the stability of the lock walls, is too apparent to need extended remark.

The nature of the rock through which the great "divide cut" and other "cuts" are to be made, is also decidedly favorable, in view of the fact that it is, as shown by the specimens exhibited, homogenous, and neither friable nor traversed by seams, nor decomposable to any appreciable extent by exposure to the elements. Hence, the sides of the cuts may be safely left at an angle but a few degrees removed from the perpendicular, thus effecting large reductions in the quantity of excavation usually required to render the slopes both safe and permanent. (See Plate I, Diagram 5.)

Passing by the lake level as not involving questions that require a study of geological conditions, I can but pause, when considering the location of the locks on the Pacific slope, to express admiration at the wonderfully-favoring geological formations which nature has furnished and the skill of your engineering department has shown to be available for those structures.

That, at the summit of the western slope of the continent at this point, there should rise, as a rampart for the long, summit level of the canal, a sufficient width of primeval rock into which the locks to regulate this mighty reservoir may be firmly bedded—thus to form the imperishable gateways of the descent to the level of the Western Ocean—is a fortuitous geological feature of great significance as presenting a perfect barrier against disastrous undermining casualties to the high-level water way, and also as affording the best possible conditions for permanance of the locks. (See Plate VII.)

A studious view of this section of the canal as it will appear when fully completed, will give force to the prediction that, when this work is an accomplished fact and when ocean steamers of the largest class, their decks crowded by hundreds of passengers, and their holds laden with thousands of tons of freight, are seen on the crest formed by Lock 4, majestically rising from, or descending to, the broad Pacific, that reaches out to the western horizon in unobstructed view below—the spectacle will be deemed to display one of the most impressive of the mighty engineering achievements of any age.

The test borings in the lower valley of the Rio Grande, completed at Brito during the past winter, show that the full depth of 30 feet will there be attained without encountering rock, and that a harbor as spacious as that of Chicago or Port Said may be made available by the simple and rapid process of inland alluvial dredging, duly protected by seaward entrance piers, thus assuring ample and economically constructed terminal facilities on the Pacific coast.

The geological conditions of the canal route are, therefore, as a whole, deemed to be of a *remarkably favorable character*.

SECOND.—*Topographical features.*

From the east the seaward approach to this grand interoceanic route is unexceptionable, as the proposed harbor at Greytown, when completed, may be entered or cleared by craft under sail, with the wind upon any quarter. Thence, extending nearly in a straight line of canal about 10 miles through the San Juan lowlands, a channel in full view from end to end will afford all possible facilities for rapid passage over the section extending between the harbor and the eastern locks.

Passing the locks, the Deseado basin will be available with extra width of water way up to the "divide cut," where a channel through 3 miles of solid rock will bring ships into the San Francisco basin, with its ample water way for clearance of counter-bound craft. Passing through three short "cuts," vessels will then enter the San Juan basin, with its surplus breadth of counter passage way caused by the water storage of the Ochoa Dam; thence into the great Nicaragua Lake; thence by canal into the Tola basin, resulting from the storage of the waters of the lake by the dam near Lock 4. This basin extends the upper level to a point but 4 miles distant from the Pacific Ocean, where in full sight of it, ships may lie, awaiting orders, making repairs, shifting cargo, unloading or transferring the same, alongside or at warehouse piers with all the unlimited accommodations of the shores of this landlocked lake at command, having upwards of 15 miles of water front, where every commercial facility may be obtained, all within easy access of the port of Brito. Graving docks of unsurpassed convenience may also be constructed in the Tola basin, owing to the ease of obtaining sluice discharge for dry-dock purposes. (See Plates VI and VII.)

The following important natural facilities for prosecuting the work of construction should not be overlooked:

Of 153 miles of route from Greytown to the mouth of the Lajas on the western shore of Lake Nicaragua, 90 miles border on water ways, with no sections of the entire work, except interiors of divide cuts, more than 2 miles distant from navigable waters, including under that head such as may be made available by certain inexpensive improvements, proposed by your chief engineer—the lines of which are indicated in red colors upon Plate I, his explanation thereof being annexed in a marginal note herewith.*

For the heavy work of the canal excavation, a construction railway will be requisite, and can be provided at moderate cost.

Along the western section, 17 miles in length, a double-track railroad will, of necessity, be provided; and must be relied upon for distribution of labor, machinery, and material. This represents, however, an average maximum haulage of less than 9 miles from either of the two bases of supply by water-transit, one being via the Pacific, and one via the Atlantic coast. The canal level being but 43 feet below the highest point on this section, it follows that subsidiary railway construction and operation along the working line will be upon easy grades with ample level spaces for side tracks and the other facilities requisite for the handling of surplus excavation, or of building material.

The paramount question of an abundant, and yet always controllable and reliable, high-level water supply for canal lockage and filtration is completely answered in this case by the presence of such equalizing reservoirs as Lakes Nicaragua and Managua. From these sources an average flow of 90 per cent. over canal-operating requirements is obtainable at ordinary level, while lowering the level of the lakes the depth of 1 foot, would afford an enormous surplus over any annual requirements, with regard to rainfall.

It appears from the latest surveys that the minimum radius of curves on the entire line can be established at 3,820 feet, which presents a route equal to a straight line, for all practical purposes of navigation.

The last topographical feature to be noted, is the ratio of minimum channel width to the whole distance to be traversed between the two oceans. This is found to be less than 16 per cent. of the whole passage. Of the entire route,† about 60 miles are in spaces sufficiently wide for the largest ships to navigate under sail, as in Lake Nicaragua; while about 76 miles are in the Deseado, San Francisco, San Juan, and Tola basins, where steamers may proceed under full headway, and pass one another in counter directions, with safe clearance space. Practically, this general result reduces the distance of canal navigation—properly so termed—between the two oceans, to about 27 miles; the remainder having the characteristic of an ocean estuary.

The result is a monument to the patient research and persistent explorations of

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*Chief Engineer's Office,
Nicaragua Canal Construction Company,
44 *Wall Street, New York, December*, 1889.

Dear Sir: I forward herewith a tracing of that portion of the Nicaragua Canal comprised between Greytown and Ochoa, showing the streams connecting the river San Juan, at the mouth of the river San Francisco and Greytown, with the eastern divide cut. The San Juanillo is navigable by craft drawing 4 feet up to the outlet of Laguna Bernard, and through this outlet and the lagoon to a point in the Deseado in the vicinity of Lock No. 4. From this point to the foot of the divide the Deseado can be made navigable with the same draught, by removing the logs obstructing the stream and the construction of three, and possibly four small low dams. In order to avoid the expense in building temporary locks to connect the different reaches into which the stream would be divided, I would be in favor of having scows in the reaches, and a derrick at each dam to shift freight from one scow to another.

The river San Francisco, when cleared of logs, will be navigable by the same class of boats to very near its confluence with the Chanchos. From that point to the foot of the "divide," on the west, the Chanchos and Limpio would afford transportation by the same method proposed for the Upper Deseado.

In this manner building material can be transported to the divide and the excavation commenced during the construction of the railroad.

Any further information you may desire, will be gladly furnished by
Yours, truly,

A. G. Menocal,
Chief Engineer.

Charles T. Haryey, Esq., *C. E.*,
City.

† Total length from extremity of entrance piers at Greytown to like point at Brito 171.429 miles. (1.513 being in Greytown Harbor, and 1.136 in Brito Harbor.)

your chief engineer and of your surveying corps, and to the wise foresight of the management in providing means for a thorough exploration of the region thus traversed preliminary to final location of the route.

THIRD.—*Engineering Problems.*—Among other striking features of the undertaking is the fact that with such ample transit facilities in view, their realization involves *no unusual or overshadowing engineering problems or contingencies.*

The locks to be built are upon a scale already in use at the Lake Superior ship canal, and with advantages over the latter in having solid rock foundation throughout their entire length.

The sea approaches and the terminal marine accommodations proposed for this enterprise present no features which have not already been met by engineering talent at other commercial centers requiring facilities of a like character or upon even a more extended scale. The precedents thus fully established leave no elements of uncertainty in this respect, and these questions, therefore, require no special notice beyond a scrutiny as to quantities and cost—subjects, however, that are not now under consideration.

Being led, in the course of this examination, to concentrate attention upon the features of the route through the highlands—commencing at Lock No. 1 on the Atlantic slope, and extending thence westerly to the vicinity of the Ochoa dam—I find the subject to be one of such rare interest to engineering minds that I have caused a series of diagrams and views designated as "plates," to be specially provided and appended hereto, in illustration of the features worthy of particular remark.

Referring to Plate No. 1, attention is called to the strides which modern engineering has made along the line of experimental research, on which your chief engineer has shown himself such a successful leader. Not many years since, the vicinity of the Rio San Juan would have engrossed the entire attention of the engineering corps, upon the assumption that, as a matter of course, it must be adopted as the base line of the lock lifts and of the canal-prism.

But patient and laborious explorations, surveys, and researches in many directions have shown a new and more desirable route to be practicable. This is accomplished by leaving the San Juan above its lower levels, and utilizing a series of minor valleys, occupied at present by insignificant streams, which when dignified by the overflow from the San Juan will, by the transformation, approach the sublimity of a new creation. This metamorphosis of mountain streams and interior valleys (now visited only by explorers and hunters) into a grand artery of interoceanic commerce, will be an achievement which the whole world may well applaud.

The process by which this result is to be accomplished is easily traceable on the first of these plates. Lock No. 1 will lift 30 feet above the valley of the Deseado and will create a lake, the overflow of which is provided for by a waste weir in the adjacent dam. Lock No. 2, with its 31 feet of lift, will, with its embankments, cause the formation of a lake rising to its level, while Lock No. 3, with its 45 feet of lift, will create a lake to fill the basin up to the base of the dividing ridge, at the point indicated on Plate I. Then follows the piercing of the transverse range of hills by the "divide cut," the dimensions of which are accurately indicated in Diagram 1, on the same plate. This is not a very formidable affair, at most; and when it is completed and three dams (see Diagram 3, Plate III) have been erected upon the branches of the San Francisco, and a "cut"—comprising less than one-third of a million yards of excavation, of which less than 10 per cent. is rock (see Diagram 2, Plate I)—connects the two valleys, a double lake will be produced, adding nearly 7 miles to the navigable water way. Another "cut" of a half million yards of earthwork, in connection with another dam at the Rio Danta (see Diagram 4, Plate III) will create an additional lake, adding 2 miles more to the navigable water way. Yet one more "cut," involving but a million and a half yards of earthwork excavation (see Diagram 4, Plate I), and we are ushered into the valley of the San Juan.

This expanse of artificial lake channels (see Plate I) requires but 24,990 lineal feet of supplementary embankments to secure their outer boundaries at points where watersheds or courses lead in other directions. This feature, coupled with the fact that most of the restraining embankments require but a few feet of elevation, the deepest gorge to be thus secured being but 21 feet below bottom level of the canal renders the aggregate of retaining embankment remarkably small. The same method has been successfully adopted in building the Ohio State canals, as the following extract from a recent publication indicates:

"The body of water which (in 1889) supplies the St. Mary's feeder of the Miami Extension Canal (of the Ohio State canal system) is about 9 miles long by 3 miles broad. It was formed by building two earth embankments from 10 to 25 feet high, one 2 and the other 4 miles long. About half of the area flooded was a prairie and the remainder a forest. The reservoir was begun in 1837 and finished in 1845."

With this example in existence, and taking into consideration the always reliable and ample surplus of the flow of the lake and River San Juan, that these valleys will prove abundantly retentive under the pressure of the proposed water filling, is placed beyond reasonable doubt.

This marvelously practicable route—having regard to the ease of formation of navigable basins and of their being artificially linked together in a continuous series—has the further admirable feature of exhibiting this feasible and ample water way extending along almost a straight line in the general direction desired.

OCHOA DAM.

The Ochoa dam is located at the point where the summit-level water way, formed in the valleys of subsidiary streams, as already mentioned, connects with the valley of the San Juan.

Here advantage is taken of a ridge of hills which contract the valley and form natural side embankments, which can be utilized with all the benefits thus provided free of cost.

The accompanying view(Plate II) of the natural ridge referred to is copied from a photographic view in the report of the United States Government survey of 1885.

These natural embankments reduce the dimensions of the dam required, as indicated by Plate III, to a size far from unusual, as is shown by the annexed table of comparative dimensions of works of this character existing in other localities.

Name of dam.	Location.	Length at top.	Total height.
		Feet.	*Feet.*
Villar	Spain	546	175.2
Gilleppe	Belgium	762	166.5
Puentes	Spain	925	164
Vyrnwy	Wales	1,350	146
Habra	Algiers	1,060	137
Tansa	India	8,500	118

Without entering into the details of the plans for the construction of the Ochoa dam suffice it to say that from the "divide cut" surplus excavation rock material wherewith to raise an embankment, answering the purpose of a dam, and of dimensions sufficient to render it as firm as the primitive hills by which it is flanked, may readily be brought by rail.

To conclude remarks upon the subject of the dams located along this route, diagrams of the largest subsidiary dams are given upon Plate III, from which it will be seen that none of them are of such dimensions as to require special consideration. The total length of all of them combined, including Ochoa and those on the western slope is, but 11,720 lineal feet, whereas in the waterstorage and aqueduct system of the city of New York alone are to be found 7,569 lineal feet of dams already constructed, and 4,206 feet additional yet to be built, making a total of 11,775 feet, which is actually in excess of the requirements, in that respect, of this entire route from ocean to ocean.

Included in the last-mentioned estimate is the structure known as the "Quaker Bridge Dam" of the following dimensions: Length, about 1,400 feet; height, 265 feet from bed rock.

This, it will be seen, has 2¼ times the superficial frontage and 3⅝ times the height of the Ochoa structure. If the criticism be made that it has not yet been completed and practically tested by use, the table on page 39 meets that objection by indicating the relative proportions of other dams of large dimensions *which are now in constant service.*

Turning westward, the effect of the Ochoa dam in raising the level of the river 58 feet at that point should be noted. It converts the lower valley of the San Carlos into a lake, the boundaries of which, indicated on Plate IV, extend southward about 10 miles in a straight line, and are flanked by hills upon the eastward side, except for the short distance of 5,540 feet where artifical embankments of but moderate elevation with due proportions of wasteweir will be necessary.

The problem of the effect of such massing of water filling upon the upper channel of the San Juan is happily one easy to solve.

Plate IV shows the course of the river to be in a well-defined valley, which maintains like characteristics throughout the entire distance from the Ochoa dam to the entrance of Lake Nicaragua, 64½ miles distant by the sailing line.

The whole distance is thus converted into slack-water navigation, and while requiring excavation at various points to secure the minimum of depth, the channel for a large part of the distance has such surplus of depth and breadth of water way as to insure the advantages of lake rather than of ordinary canal or river navigation.

Plate V, from a photograph in the report of the United States Government survey of 1885, presents a very clear idea of a portion of the upper waters of the San Juan

River—above the Ochoa dam. The view represents the locality near the Castillo rapids, midway between the dam and the great lake. The channel surface at this point will be raised about 20 feet, and it will be seen from the view that the banks of the stream are ample to keep the ultimate enlargement of the volume of water within favorable bounds.

The amount of dredging required to secure a navigable channel from the junction of the "divide" channel with the San Juan slack-water course, to keep deep water in Lake Nicaragua, has been ascertained to be 7,275,590 yards, distributed over a distance of 44 miles, including 14 miles of channel, deepening between the river head and deep water in the lake itself.

These results carry with them the proof of a grand conception and no words of mine are requisite to add to their force upon appreciative minds.

Passing beyond the magnificent expanse of lake surface, where navigation is unobstructed (in one portion of the course the distant shore scarcely appearing above the horizon), the construction operations necessary to extend the canal through the western land barrier, 15 miles in width, next claim attention.

This portion of the work displays among its features engineering devices of more than usual interest, shown upon Plates VI and VII. The first point for remark is the changing of the bed of the Rio Lajas near the lake, to prevent its crossing the line of the canal. This operation is favored by local topographical conditions, and frees the canal along that section from interference by floods. Thence by easy curves the canal crosses the divide between the Atlantic and Pacific slopes, through a cut, of which the banks rise to but 41 feet above the water level. What a monument to the exhaustive preliminary explorations and surveys made under the direction of your indefatigable Chief Engineer exists in this fact alone! Those who know, or who will trace the course of the stage-route between Lake Nicaragua and the Pacific coast, opened by Cornelius Vanderbilt in 1850,* will best appreciate the natural advantages of the route selected for the canal.

The next feature is the Tola River or La Flor Dam, the dimensions of which are indicated on Plate III, Diagram 2.

Located in a gorge of the mountains, and but 4 miles distant from Brito Harbor, it creates a lake of such proportions as to add 5½ miles of navigable water way to the route, with no watershed leading westward requiring border embankments to guard the same. Here ends the summit level of the canal, extending from within 4 miles of the Pacific, to within 13 miles of the Atlantic, and including a system of natural reservoirs which appear as if originally planned to provide a water supply, unfailing and easily controlled, and which could hardly be surpassed for the purpose to which it is now to be applied. The situation of the locks have been hereinbefore remarked upon, except as to their lifts, which comprise two of 42½ feet each, Nos. 4 and 5, while that of No 6 is but 25 feet, as indicated upon Plate VII. Referring to the profile showing the relative position of the rock strata along the route, further mention of the admirable features connected with their location is not requisite, in view of the proofs afforded in Plates VI and VII.

The harbor of Brito, it will be noticed, lies in a comparatively sheltered position, and yet, like that at Greytown, can be entered by vessels under sail, with the wind upon any quarter.

Thus far as to the salient engineering features of this undertaking.

FOURTH.—*Climatic conditions.*

That climatic influences upon the general health of workmen, especially when migrating to a great distance in the execution of public works of such magnitude as that now under consideration, affect largely the monetary cost of the same, none can doubt. Those enlisting to labor in such undertakings invariably and wisely, take into account the possibility of detrimental effects of the climate upon their health, when stipulating as to remuneration.

After careful and extensive inquiries in that regard, I am satisfied, as I think other candid minds must be upon similar investigation, that the health conditions are, in this case, essentially favorable to the work, and that the section of Central America traversed by the canal is entitled to be classed as a healthy region.

The lowlands of the San Juan are the most exposed to miasmatic influences; but the work there being wholly done by machinery, and the operators being mainly under cover and subject to control as to matters of food and sleep, modern sanitary appliances, as previously remarked, will neutralize such deleterious influences to a great extent.

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*The course of this once frequented route can be traced upon the model lately on exhibition by the Maritime Canal Company. In traversing this "divide' travelers were led across elevations over 600 feet in height.

On the highlands of the eastern slope, where the greatest number of men will be required, the drainage is good, with clear spring water in abundance. The well-known trade winds of that zone circulating from ocean to ocean with a regularity found nowhere else on this hemisphere, clear the atmosphere and moderate end equalize the temperature to a degree affording incalculable benefits and physical comforts along the San Juan Valley,* while in the vicinity of Lake Nicaragua and on the Pacific slope the same proverbially healthful climatic conditions are found as prevail upon the coast of California.

A practical proof of the reliability of these conclusions is supplied by the record of the company's surveying corps of 1887–'88, consisting of sixty men transported from New York and more than one hundred natives enlisted on the spot, all of whom encamped along the line for many months; and yet, as Ensign Maxwell informs me, not one of the party was prostrated for more than a day or two by sickness, and the original party returned to New York in better general health than when they left that port.

This incident, so recently and so reliably attested, has a special and most favorable significance.

FIFTH.—*Commissary, sanitary, and police organization and supervision.*

The affairs of administration indicated by this caption all pertain to the cost of carrying on the work, and while more especially within the business department of the enterprise, seriously affect also its engineering resources, consequently they are deemed proper to be herein mentioned in an advisory way.

The quality and quantity of food to be furnished to the working force should not be left to the caprice of speculators, nor to be dispensed by those seeking a profit in so doing, for upon the maintenance of a proper standard and supply of diet largely depends the reliability and vigor of the laborer. Neither should sufferers from accident or sickness be committed to the care of casual sympathy or chance acquaintance. The company should retain control of the food supply, and medical and surgical care and attendance should be regulated by special arrangements which will secure reliable and competent management of details in these important departments.

My own experience as business manager of the company which built the Lake Superior Ship Canal enables me to state that in that undertaking the observance of such a policy as here indicated was an indispensable element of the success then and there attained. Before the visitation of epidemic cholera in 1854 official control of the food supply and the medical oversight of about four-fifths of the working force of nearly three thousand men was committed to my charge, and a hospital with a corps of skilled attendants was also instituted under my supervision. When these precautions were tested by that terrible scourge the result disclosed a loss of less than 5 per cent of the cholera cases under my control, as against a loss of fully 95 per cent of those who did not come within the lines of my sanitary regulations—in an aggregate of several hundred deaths at that time and place.

It is assumed that your company, directed by a wise foresight, will organize and retain control of an efficient police and sanitary corps, patrolling the entire line of work for the enforcement, not only of personal and property rights, but of strict and comprehensive sanitary and sumptuary regulations.

SIXTH.—*Sources of labor supply.*

When considering this important element of cost, I learned from reliable sources that hardy and efficient laborers at lower rates of wages than are current in this vicinity may be obtained in large numbers from the west coast and from the mountain districts of Mexico. Also, that negro labor, duly acclimated, may be drawn largely from the Mississippi Valley and from the West India Islands. Southern European countries, it is well known, can contribute sturdy white workers of a higher grade, while skilled labor can be furnished in abundance from this vicinity; and from all these sources workmen can be conveyed by water direct to the line of the work. These conditions are, therefore, to be classed as remarkably favorable in all respects.

This subject completes the list of features worthy of special consideration, which together constitute the conditions of which a knowledge must precede the formulation of reliable estimates of the cost of the proposed undertaking.

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* This portion of Central America is elevated but 110 feet above tide level, being the least obstructed by mountains of any part of the Pacific coast from Alaska to Patagonia. The refreshing trade winds, with a freedom of circulation caused largely, no doubt, by the remarkable depression in the longitudinal mountain ranges (elsewhere presenting barriers ranging from 1 to 2 or more miles in height), here maintains a "stiff breeze" during several hours of each day throughout the year.

CONCLUDING OBSERVATIONS.

The revised estimates of the advisory board were concurred in by me as embracing an ample estimate of the cost of constructing the Nicaragua Ship Canal under favorable conditions of financial administration and executive ability.

In that estimate there is, in my judgment, a margin for contingencies sufficient to include the enlargement of the locks from the capacity proposed by your chief engineer to the advisory board, viz, 650 by 80 feet chambers, to the size I would earnestly recommend for adoption, viz, 1,000 by 100 feet. These dimensions will be of the same width and but 200 feet longer than those adopted for the new lock of the Lake Superior Canal, where experience has demonstrated the economy in time, or locking through several vessels together. The reasons for this increase I will, if desired, submit in a separate report at a later date, prior to the time when the progress of the work will necessitate your decision.

To my mind it seems clear that when investors examine the schedule of cost as reported by the advisory board, the more scrutiny they bestow upon it the earlier will they reach the conclusion that under no ordinary contingencies will it be exceeded by the actual outlay; and that when open for traffic the canal finances will be as easy of management as its water way. When thus opened, the crisis of both will have been passed, and both alike will command the admiration of the world. Let him who desires to leave his accumulating wealth where his posterity will find it intact in form, and of constantly increasing value, from the growth of commerce between the nations, duly appreciate this golden opportunity.

The world at large may adopt many novelties in methods of transportation, but to supersede the economies secured by such an interoceanic water way is not among the possibilities of human progress. The expenses of the Lake Superior Ship Canal in lock lifting nearly 8,000,000 tons of tribute-paying freight during this year are officially estimated at $36,000, or at the rate of about four-tenths of a mill per ton. What other form of transit can present such results?

REVENUE ESTIMATES.

It will be presumed that in a general review of the principal features of your enterprise the important subject of the extent of its probable traffic will not pass unnoticed; but while appreciating that fiscal promise is the one prerequisite of every incipient enterprise, of this nature, I leave this branch of the subject to others whose experience renders them more facile than myself in that line of expert estimate.

COMPARISONS.

The old adage that as between persons "comparisons are odious" applies, in my judgment, with special force to indiscriminate suppositions of parallels between existent or proposed ship canals. Many have assumed a similarity of conditions as affording a basis of comparison between the Nicaragua, the Suez, or the Panama routes; and, moreover, finding errors in calculations proven in the estimates of cost in the last named enterprise, they proceed to infer like results in the first, especially in the line of deductions respecting the unreliability of engineering estimates relating to the time and cost of construction in one of those undertakings as applicable alike to all of them, when in fact there is and can be no practical ground of comparison. To emphasize this conclusion it may be well to devote a short space to a review of the main features of the other projects thus compared with the Nicaragua enterprise.

THE SUEZ CANAL.

Let the Suez Canal be first considered. It is a water way, excavated mostly through a sandy desert for a distance of 88 miles,* connecting two tide-level seas. It was projected as long ago as in the time of the Pharaohs. The historian Herodotus, who lived in the fifth century B. C., asserts that Pharaoh Necho expended 120,000 lives working upon it. The same writer refers to it as being used in his time and as wide enough to admit of the passage of two vessels abreast, while the passage is described as occupying four days.

It was subsequently allowed to fill up with the shifting sands of the desert and it remained thus until its restoration was undertaken by M. de Lesseps, in conjunction with the Khedive of Egypt, in 1858. It was formally reopened November 17, 1869.

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* Sixty-six miles of dry excavated channel, 14 miles of dredged, and 8 miles of natural-lake passage way.—Encyclopedia Britannica, Vol. IV, Page 791.

The problems presented were, from an engineering point of view, of the simplest kind, involving merely an open cut upon and between tide levels. It has, however, as to its main features, to meet a danger and expense that was and still remains unique; namely, the constant tendency of natural causes to choke it with shifting desert sand. This menace requires the counter force of dredging and led, at the outset, to opinions by distinguished engineers that the income would not warrant the expense. It has, however, been a triumphant vindication of M. de Lesseps' faith in the ultimate success of the undertaking; in 1888, with a total income of 45,242,021 francs but 7,743,064 francs were required for the operating expenses. The increase of revenue for 1888 over 1887 was 12½ per cent. The average time of passage was 30¾ hours. The latest annual report shows that 3,998,914 cubic meters of sand were removed from the canal during that year. This represented, in part, the accumulated drift from the desert simoons, and also the excavation consequent upon gradually widening and deepening the channel. It is reported that this work will be so far completed by another year that two vessels will have clearance for counter passage at any point.

It is now about twenty-one years since the narrow channel was first opened for traffic. The proportion between sand drift and new prism area removed last year was not stated in the report, but there is no doubt that were this continuous warfare against the climatic force which dominates in that desert region to be altogether abated, the canal would, in the process of time, be quite obliterated for many miles of its length.

These being conditions peculiar to the Suez Canal, how evidently absurd is any attempt to draw engineering comparisons between it and the Lake Nicaragua route.

THE PANAMA CANAL.

Comparative examination of the Panama project, however useless from an engineering standpoint, yet, as connected with M. de Lesseps, the successful projector of the Suez Canal, invites a measure of consideration, as affording an interesting study of the history of an attempt to make assumption wear as well as fact.

To studious engineering minds the Panama problem originally presented collateral difficulties equal to those incidental to the canal itself. The route of the canal from Colon westward follows the ascending valley of the Chagres River. That water course must be controlled, but how? Given a river draining an area of about 1,400 square miles; discharging in the dry season at its first point of contact with the line of the canal 15 cubic meters of water per second, but in the wet season 4,670 meters *in the same time,* precipitated mainly from numberless steep ravines and high mountain sides, from whence the rainfall quickly concentrates in the main outlet and often in a few short hours, causes a rise in the Chagres River of from 20 to 60 feet in height of solid water pressure, increasing its volume to *over three hundred times its minimum discharge!* * This, M. de Lesseps contended, might be controlled or eqalized by a reservoir. To accomplish this end a stupendous dam a mile or more in length, 120 feet high, and 250 feet thick at base, was calculated by French engineers to be necessary, and was to be located south of the canal and at a considerable distance therefrom in a subsidiary mountain gorge.

But even with the dam complete the overflow must still be provided for. To dispose of this there was proposed a tunnel, to be bored for miles through the mountains, with dimensions sufficient to convey the surplus flood into another valley for exit to the sea.

That M. de Lesseps should seek every possible way to avoid the cost and delay of these gigantic preliminaries is not surprising; but for the ostrich-like policy of hiding the head of the dilemma by means of a vigorous show of digging upon the canal proper, while the body of the difficulty remained uncovered, there could be but one ending, namely, the probably irremedial disaster already developed. The giant floods of the uncontrolled Chagres River now hold undisputed sway over the route of the canal whenever appearing in their torrential strength.

Other difficulties, more or less serious in their nature, must be overcome to achieve final success in the line of that effort, but one of which will now be remarked upon.

It was the popular impression obtaining at the time of its commencement that the Panama was, like the Suez route, to be a tide-level canal.

But tidal differences existed which precluded such similarity. The tides of the Mediterranean Sea have but 12 inches of variation between high and low tide. Likewise those of the Red Sea change but 30 inches from mean level; hence a connecting channel between them through an "open cut" was practicable. But on the Panama route, while the maximum variations of the Atlantic tides at Colon are but 1 7/12 feet, those of the Pacific at Panama show changes of 21$\frac{3}{12}$ feet in level. This feature, it will be readily seen, necessitated the existence of at least one lock on the Pacific coast, and if but one, then with double gates to meet the alternate water pressure in opposite directions.

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* Some expert estimates place the maximum of these floods at 165,000 cubic feet per second, or at nearly half the flow over Niagara Falls!

And yet it was generally understood that the original plans called for *no locks* in the Panama route. Afterwards, this feature was reconsidered, and a series of locks were officially announced—but without provision for supplying the highest level, except by pumping.

Such circumstances point to the conclusion that there had been no carefully studied and matured plan of construction, with a fixed estimate of cost, but only a vague and uncertain groping after a result—to be arrived at by whatever means circumstances might determine, and at whatever expenditure of time, money, and life, chance should decree. The case is therefore in no wise analagous with the Nicaragua route, excepting as to the use in common of the word "canal."

My conclusion is, that the only canal which can at present be referred to as similar to your enterprise, is the one of which a sufficiently extended notice has been already given, to wit:

THE LAKE SUPERIOR SHIP LOCK CANAL.

It ranks with yours in its lockage capacity; like yours, it has an enexhaustible reservoir on its upper level; and again, like yours, it has required the deepening of natural water courses to furnish a continuous and capacious ship channel. Also, this canal was built within the original estimates of time and cost. It has been in uninterrupted use for over a third of a century, and maintains an ever-increasing volume of traffic—which is but an example of what the Nicaragua Ship Canal will demonstrate in its cost and durability, and will develop as to dividend-earning qualities, whenever a suitable opportunity is afforded to test its performance.

IN CONCLUSION.

When taking leave of this subject, the professional mind is led in two directions:

First.—Retrospectively.—Upon looking back to the commencement of the present century, the retrospect discloses the energies of the world engrossed, in the main, by the profession of arms and in warfare on land and sea. Railroads and steamships were unknown, and the science of engineering was in its infancy—even the title of civil engineer being almost unused. On the first of January, 1891, the last decade of the century will have commenced. What a change will then be traceable between the opening of the first, and of the last tenth of the cycle! Now, the engineering profession, including therein its civil, mechanical, and architectural divisions, is in the van—the leader of the world's energies.

Second.—Prospectively.—Notwithstanding the vast strides with which modern improvements have lately advanced, it is safe to assume that the last decade of the century will witness its most notable achievement in the completion of the inter-oceanic canal of Nicaragua. In the progress of its construction the power of applied science will have its fullest scope.

Mammoth dredging machines, unknown to our fathers, will plough their way with irresistible force and marvelous rapidity from the shores of the Caribbean Sea to the foothills of the San Juanillo range. There, steam and air drills and the dynamite genii will attack the rocky ledges, and where naught but the untrodden wilderness can now be seen, leave behind them the grandest highway of the nations. When the locks and dams have taken form, Lake Nicaragua will become a central rendezvous for the fleets engaged in the commerce of the new world. Electric lights will render the dark cañons of the "divides" and the entire route of the canal, as passable by night as by day; and by its far-reaching wires, the telegraph will convey dispatches from every section of the noble water way to the commercial centers of both hemispheres.

All these forces, in combinations not known or suggested in A. D. 1800, will, no doubt, before A. D. 1900, have secured the completion of this grand conception. That it will be a fitting culmination of the engineering achievements of the Nineteenth century, who can doubt?

I have, in conclusion, only to remark that I shall deem myself honored by having aided forward, in anywise, the consummation of this project, insuring such vast utilities; and also that I feel impelled from the study of the data referred to herein, to congratulate its managers upon having already guided it to so favorable an opening of its record.

Very respectfully,

CHARLES T. HARVEY,
Civil Engineer.

NEW YORK, *December*, 1889.

APPENDIX C.

To the Stockholders of the Nicaragua Canal Construction Company:

I take pleasure in presenting to you the report of the division engineer of our company, covering the work performed prior to October 8, 1890, and also the report of our chief surgeon upon the hospital service and the general health of the employés of the company in Nicaragua.

The report of the division engineer is a very complete statement of the work done by our company, and will, I believe, satisfy all interested that the work during the past year has been pushed with great vigor and success. The health of the force during this time has been remarkably good, and there is no longer any fear that the work can not be successfully prosecuted because of climatic causes. I also have to report that our concession from Nicaragua was confirmed by the Nicaraguan Government early in November; a commission appointed by the President of Nicaragua having made a thorough examination of our work reported to the Government that we had complied with all the provisions of the concession, and had expended much more than the $2,000,000 required to be expended during the first year. By the confirmation of the concession the rights of the canal company have been rendered permanent.

I am also able to report that the depth of water on the bar at Greytown is now 12 feet; having received a cable a few days ago from Chief Engineer Menocal to that effect. It is expected that the water on the bar will be deepened to 20 feet within the next four weeks, which will give us a sufficient depth of water for all vessels to enter the harbor and unload at the company's wharves. I therefore feel justified in congratulating the stockholders of the Nicaragua Canal Construction Company on the present favorable condition of the work.

Yours, truly,

WARNER MILLER,
President.

NEW YORK, *December* 17, 1890.

REPORT OF THE DIVISION ENGINEER.

WORK PERFORMED BY THE NICARAGUA CANAL CONSTRUCTION COMPANY PRIOR TO OCTOBER 8, 1890.

SAN JUAN DEL NORTE, NICARAGUA,
October 19, 1890.

SIR: I would most respectfully submit the following report of the work done by the company in Nicaragua prior to this date.

The surveys for the final location of the entire canal line have been completed and the detail surveys of the sites of all embankments, dams, and locks are very nearly finished.

This survey has covered not only the one line selected, but any and all routes which gave any probability of being practicable, and in many cases covers a width of several miles of country.

In addition to actual surveys the whole country has been thoroughly explored, so that every range of hills and every small stream has been examined to ascertain what, if any, bearing it might have upon the general problem of construction.

The south bank of the Rio San Juan has been carefully examined from Ochoa to the Rio Colorado, and extending back from the river several miles, to ascertain if there was any more favorable location for a dam than the Ochoa. Most of this region is a lagoon country, with low disconnected hills. No favorable site for a dam was found.

The surveys for a railroad line from America to Ochoa, keeping above the flowage line in the basin, have been completed. It was a difficult piece of location, as the hills bordering the basin are very steep and badly cut up with lateral drainage.

The cheapest and best line for the railroad would have been found on the crest of the ridge bordering the valleys of the Deseado and Limpio, on the south side; but as this ridge is from 400 to 1,000 feet in height and from 1 to 3 miles away from the canal, it would be of no use for construction purposes. So we were forced to locate on the hillside, necessitating a great deal of very careful work to make a location that was at all practicable.

Another line has been located from America to the divide for a temporary road for constructing purposes, keeping in the valley of the Deseado. As the Deseado is a very crooked stream, with high hills coming down to the water on both sides at frequent intervals, it required a large amount of preliminary work to decide on the best location.

Careful detail surveys have been made for the location of a dam and reservoir on the La Paz Creek, about 12 miles from this place; also for the pipe line to bring the water from that point to America. Several other streams were examined and careful surveys made to ascertain where the best and most economical supply could be obtained. All things being considered, the La Paz was found to be the most desirable.

At the points selected the stream has an elevation of 100 feet above tide and pours over a ledge of trap-rock between two high hills, forming an excellent site for a dam, which will raise the water to an elevation of 115 feet.

The stream in the dry season will furnish a supply of pure, cold water, amply sufficient for all the demands likely to be made upon it.

A careful survey of the site of the proposed harbor at San Juan Lagoon has been kept up during the past year. This has been necessary to keep a record of the rapid changes which have taken place, owing to the construction of the breakwater.

In order to make the proper studies of the work, it has been necessary to make new maps of the coast line for some distance on each side of the breakwater each week and also to show the depth of water ascertained by careful sounding, extending from the lagoon across both the inner and outer bar to deep water. One party has been constantly employed on the work.

A careful survey is now in progress, and nearly completed, of the country between the mouth of the Lajas and Brito for the location of a railroad, to accurately locate all the property lines, to decide where diversions of streams are necessary and practicable, and to locate sites for disposing of waste material.

All the surveys have been carried out in such a manner as to check the accuracy of each other, and no errors have been allowed to go uncorrected.

The maps have been made with the utmost care to insure correctness. All work has been carefully checked by at least two men. I have no hesitation in saying that no important error can exist in the surveys or maps. I have never seen or known of so exhaustive and accurate surveys and maps having been made for any public works.

These surveys have necessarily been slow and expensive, being prosecuted in a tropical forest where nothing could be seen at a distance of 50 feet, and where every step had to be preceded by a blow from a matchet to clear away the tangled mass of vines which everywhere presented itself, where all supplies had to be transported in canoes up streams filled with logs and then packed on men's backs for miles over hills so steep that a man can only climb up and down by holding on the small trees and brush, much of the time with the rain pouring in torrents, or through swamps where for long distances men have had to flounder through thick mud from their waists to their armpits in depth. To one who has never conducted such a survey no description can give an accurate idea of the slowness, difficulty, and disagreeableness of the work; but you, who have personally conducted so many surveys in this country, do not need any further comments.

At first it was attempted to house the engineering party in tents, but experience soon showed that they would not answer in this climate and they were abandoned, the parties living in shacks, thatched by palm leaves. Many thousands of dollars have been spent in building temporary camps for the accommodation of employés.

To ascertain beyond question what the character and cost of the work was to be, borings have been made at the site of all important works, such as dams, embankments, and locks as well as at the heavy cuts. Where there were no rocks this has been done with earth augers. Wherever rock was found the diamond drill was used. Specimens of all the different strata have been preserved for future reference. These holes have been bored to the bottom of the canal, or to the bottom of the foundations of all locks, etc. Many of these holes have been from 200 to 300 feet in depth. By using the diamond drill, which takes out a solid core, we have been able to preserve specimens, so that contractors and others interested may at any time see exactly what the work will be. Owing to the difficulties in transporting heavy machinery, steam drills were impracticable, so all this work has been done by hand.

In May, 1889, a large force of engineers and foremen, with supplies and machinery, left New York and landed here early in June, to begin the actual work of construction, but owing to circumstances over which the company had no control, the work of construction did not assume important proportions for several months. In the mean time much necessary work was done.

As the company had no quarters to accommodate a large force of men, a temporary camp and storehouse were constructed at Camp Francis, at an expense of several thousand dollars. This was used until the new storehouse and quarters at La Paz were completed.

Several other camps, Camp Folly, Camp B, No. 1, etc., were built at a large expense, as, also, was a temporary wharf, which had to be constructed before lumber could be obtained, and which, while they answered their temporary purpose, were soon abandoned and entirely disappeared.

A steam snag boat was put to work clearing the streams—up which supplies must be taken—of logs and overhanging trees. These streams were filled with logs, the accumulations of ages, many of which were buried in sand and as heavy as lead. They could only be removed by the assistance of divers and a liberal use of dynamite.

The San Juanillo and Deseado were cleared so as as to give steam navigation to Camp Satisfaction, a distance of over 30 miles by river, and to Camp Virginia for canoes in ordinary water. From Camp Virginia to the divide, a distance of 5 miles, about, a good trail for packing was cut and foot bridges built across all the streams, so that supplies could be transported with certainty, though slowly, to the divide.

As it was proposed to obtain a temporary supply of rock for the pier from Silico Lake, the outlet of the lake, which was a very crooked stream, filled with grass and snags, was cleared out, straightened, and widened so as to allow tugs and lighters to pass from the San Juanillo to the lake; in many places points which were too sharp to allow a boat to pass around were blown off with dynamite and cleared away.

The San Francisco was cleared above the junction of the Chanchos, and the Chanchos cleared to Camp Salinas. These streams were all in a very bad condition and required much labor.

The necessity for a telegraph line to the interior soon became apparent. This was one of the first works undertaken, and was pushed through to Castillo, a distance of 60 miles, as soon as possible. This was a difficult line to construct, as the first 10 miles was through the deep swamp back of San Juan, where the clearing was difficult and the poles hard to obtain, where the wire and all other supplies had to be carried on the backs of men, who were wading in water from 1 to 4 feet in depth. Much of the way the water was so deep that poles could not be set in the ground, and had to be fastened to stumps with wire as the only means of securing them. From the Divide to the Castillo the line is over a very rough country, was an expensive line to construct, and is a difficult line to maintain.

During the summer of 1889 some preparatory work was done at Silico Lake and quite a sum of money expended in building a crib and sheet-pile wharf. No active work on the excavation of rock was done until July, 1890, when a force of men was put to work and all the rocks which have been used at the breakwater quarried. The quarry was only a mass of large bowlders imbedded in clay. This supply has been exhausted and the quarry abandoned. The rock was brought from the quarry to the pier in lighters, and as it all had to be handled twice after being quarried, it was very expensive.

During the summer of 1889 permanent buildings were begun and building construction has been in progress ever since.

The following list gives the size and purpose for which the more important buildings were erected:

Buildings.	Dimensions.	Buildings.	Dimensions.
	Feet.		*Feet.*
Chief engineer's, two stories	24 by 40	Mess hall at La Fe	25 by 50
Office and officers' quarters, two stories	25 100	Carpenter shop	20 50
Dining room for officers	20 40	Paint and tin shop	12 25
Kitchen for officers	20 20	Oil house	20 30
Laundry at headquarters	30 16	Storehouse	24 54
Bath house for chief engineer	8 10	Office and officers' quarters at railroad	24 45
Bath house at headquarters	8 22	Mess room and kitchen at railroad	16 26
Outbuildings, etc	....	Mechanics' quarters at railroad	24 60
Doctors' residence, two stories	41 47	Laborers' quarters at railroad	35 170
Officers' hospital, two stories	30 48	Laborers' quarters kitchen at railroad	24 49
Laborers' hospital, two stories	20 93	Tool house	12 17
Mess hall of patients	30 54	Tool house and blacksmith shop	24 60
Storeroom and quarters	19 25	Water tank for locomotive	....
Dead house	15 27	Engine house	36 86
Bath house, two stories	11 11	Officers' quarters at Camp Cheney	30 40
Outbuildings, etc	....	Laborers' quarters at Camp Cheney	25 96
Laundry for hospital	15 37	Storehouse at Camp Cheney	....
Storehouse at La Fe, three stories	39 139	Blacksmith and machine shops at Camp Cheney	....
Dry house	15 37		
Quarters for employés	15 40		

There is now in process of erection a machine shop, 108 by 54 feet, and a blacksmith shop and foundry, 28 by 52. Much of the machinery for a first-class machine shop is now here; also materials for a building for offices and quarters, 46 by 57, two stories, foundations of which are completed. These are all good, substantial buildings, roofed with iron and painted.

The storehouse of La Fe has a substantial wharf, 30 by 50 feet, with shears and tackle for unloading heavy freight.

Work in the canal clearing was begun in January, 1890, and about 11 miles chopped the full width of 486 feet; a large part of this was burned during the dry weather of April. The chopping through the swamp was done in January, when there was a rainfall of 64 inches, and the water was very deep in the swamp. This could have been done at a less cost at a later date, but it was felt that it must be done then to allow the first dry season to be taken advantage of for burning. This was the most difficult portion of the line to clear.

As all the water in the vicinity of San Juan del Norte is contaminated by decaying vegetable matter, it was decided to seek a pure supply in the highest hills back of the swamp.

After a careful examination of several sources, the Caño La Paz was finally selected. At a point about 10 miles from here this stream flows over a bed of solid trap-rock at an elevation of 100 feet above tide. At this point the valley is narrow, being shut in by high hills, affording an excellent site for a dam. The dam will be 15 feet in height, and will raise the water in the reservoir 115 feet above tide. With this elevation the reservoir will contain a supply sufficient for several weeks for all the demands likely to be made upon it.

The water will be brought to this point in a steel pipe 8 inches in diameter. All of the materials are here, including gates, sluices, screens, valves, connections, etc., and 15 miles of pipe. The site of the reservoir is cleared, and the laying of the pipe is only waiting for the railroad to reach that point, as the pipe for most of the way will follow the railroad.

In 1889 a tramway was constructed from La Paz to the hospital, a distance of a mile and a quarter.

In June, 1890, a railroad was begun across what has been considered the impassable swamp, between the San Juan Lagoon and the Benard Lagoon. Soon after beginning, heavy rains set in, and the swamp was flooded to a depth of from 2 to 4 feet. The track had to be laid in advance, and the dirt for filling brought out by train. This was done by building up a corduroy of logs, and laying the temporary stringers running lengthwise of the track, on which the ties were placed and the track laid. Most of this work for a distance of 2 miles was done in water 3 feet deep, and much of the work for 4 miles more in water 2 feet or more in depth, making a total of 6 miles of swamp work. After the rails were laid the trains of dirt were pushed out and unloaded along both sides with a ballast unloader, and as the bank was raised above the water the track was raised and put into shape on a solid roadbed of sand. In order to make the road safe at all times, the grade has been put above the highest known water. As this could not be done at once there has been a large force of men at work raising, lining, and stamping the track since construction began. The materials for the road have been excavated from the entrance of the canal by a steam shovel, capable of handling 1,300 yards of dirt in a day, and hauled to the point needed by trains of flat-cars, carrying about 240 yards to a train. There is now about 4¼ miles of main track laid, extending to the crossing of Benard Creek, at B. J. This bridge is finished and ready for the track to be laid. The bridge is 180 feet in length. Considerable difficulty was experienced in getting a foundation, and some of the piles were driven to a depth of 90 feet below water.

Beyond B. J. the clearing is done and the grading well advanced to a point 10 miles from Greytown. The materials for all of this and 7 miles more are all on hand, except a portion of the ties. In addition there are 1½ miles of side track laid and a considerable amount of working track.

The road is well equipped for construction work, having two powerful locomotives, one weighing 36 tons and one 44 tons, and a heavier and still more powerful one is now on the way here. We have in use fifty cars of various kinds, one steam shovel, a ballast unloader, lifting jacks and all appliances necessary.

At the terminus of the railroad a fine wharf, 30 by 264 feet, has been built, all the timber for which was creosoted in the best possible manner. This wharf is thoroughly protected by fender piles and wales, and is built to sustain any load which may come upon it. It is provided with a derrick and steam-hoisting engine, and has a railroad track laid on it so that materials may be loaded directly from the lighters on the cars by steam. Over 100 feet of this wharf is in 12 to 14 feet of water.

A breakwater for the protection of the entrance to the harbor, now being constructed at the eastern terminus of the canal, was begun in December, 1889, and has already been built out a distance of 715 feet into the sea, and is now being continued and will be carried out to a distance of 1,900 feet.

The breakwater is 42 feet in width, and is constructed by driving piles in bents 8 feet apart, each bent having twelve piles capped with a 14 by 14 inch timber drift-bolted to top of four piles, on which it rests, and firmly secured to the remaining eight piles in the bent with screw bolts. On top of the caps, and firmly bolted to them, there are eight stringers of 12 by 12 inch timber, running lengthwise of the pier. Each bent is thoroughly braced transversely by six diagonal pieces of 4 by 10 inch timber spiked to the opposite side of the piles. Along each side of the pier piles are put in between the bents as closely as they can be driven, thus forming a solid wall of piles along each side of the pier. The spaces between the rows of piles running lengthwise of the pier are filled with brush mattresses, about 2 feet in thickness, which are sunk into position by being loaded with rock. Alternate layers of brush and rock are being put on until an elevation above high water is reached. As this is being filled in, the waves bring sand and deposit it so that the whole space is thoroughly filled with a composite mass of brush, rock, and sand, through which it is impossible for worms to penetrate, and by its weight making a structure of great strength and stability. To insure the greatest durability, none but creosote timber, containing 16 pounds of oil to the cubic foot of timber, is now being used.

For the purpose of handling materials economically, a standard gauge railroad track has been laid as fast as the work progressed, and a substantial railroad built from the pier to deep water in the lagoon, a distance of a quarter of a mile. This road crosses two arms of the lagoon on substantial pile bridges, and at the terminus has a wharf with a derrick for discharging materials which are brought from the main land in lighters. There has also been built a wharf 20 by 30 feet, with storage bins, for the reception of coals.

As the pier advanced the waves were deflected, so that they began to cut in behind the breakwater and threatened to cut the buildings off from the pier. To prevent this a wing wall of sheet piling has been driven along the channel from the pier to the open lagoon, a distance of 700 feet, effectually preventing any further tendency to cut away the beach. The bottom of the sea beach here is very hard sand, through which it would have been almost impossible to drive piles by the ordinary method; this became evident soon after starting the work, and the experiment of sinking them with a water jet was tried; this proved eminently successful, affording a quick and economical solution of the problem. As the pier advanced the sand was filled in on the east side, so that there is now solid land out nearly the entire length of the breakwater, adding greatly to the strength and safety of the structure. On the west side there was a bench 100 feet in width and 6 feet in height; this the sea has cut through, giving an opening of about 600 feet in width and a channel with 6½ feet of water at low tide, through which all the lightering to and from the vessels has for months been done. This opening and maintaining of a channel, without dredging, is the best possible proof of the final success of the plan adopted for the formation of a harbor.

The bar in front of the San Juan lagoon has long been known as one of the most dangerous places on the coast in rough weather, and it is with no small satisfaction that I say the breakwater has been carried forward through the heavy surf, which prevails here during several months of the year, without even stopping on account of weather, and without an accident of any kind, or the loss of a life. The dredging plant, purchased of the American Dredging Company, consisting of several dredges, steam tugs, lighters, contents of a machine shop, etc., have begun to arrive, there being already five dredges, nine lighters, and several hundred tons of machinery and supplies delivered here. The dredges are being put in order as fast as possible, one being already at work cutting a channel across the bar to deep water outside.

A contract has been let to the North American Dredging and Improvement Company of New York for dredging 1,500,000 cubic yards in the proposed harbor at the eastern terminus. This company has now one dredge and a large scow, and a large plant of dredgers, scows, and tugs now on their way here.

A contract for clearing the right of way from Lake Nicaragua to the Pacific has been let, and work will soon begin on this portion. A large amount of supplies, tools, and machinery, consisting of steam boilers, rock drills, hoisting engines, railway appliances of all kinds, etc., are now on hand and ready for work.

In all the work done the aim has been to have everything first class, and no expense has been spared to secure this end. In many cases inferior material might have been used at a great saving of first cost, but this has not been done.

All the timber of the breakwater, the railroad wharf, and permanent bridges, is creosoted in the best possible manner. Creosoted railroad ties are being brought from the United States at a cost of about four times what ties of native wood could be bought for. The capacity of the creosoting works to its utmost.

All the employés, both officers and laborers, are housed and fed by the company. It would undoubtedly seem to be cheaper not to do this, but laborers would not receive as good food nor as comfortable lodging, and sickness would be the result.

At an early date an excellent hospital was established, where all the company's employés are treated free of cost. This, in connection with the care taken of the employés, has kept the sick list down to a point which would be considered excellent in any climate. The death rate among laborers has been remarkably small, and there has not been a death among the officers from sickness.

In conclusion, I would call attention to the great difficulty under which the work has been done.

In times past it was no uncommon thing for vessels laden with only ordinary packages of merchandise to leave here without discharging their cargoes on account of the unprotected anchorage. We have been compelled to unload locomotives, steam shovels, pile-drivers, railroad cars, etc., in packages weighing as high as 15 tons, receiving them on board lighters in an entirely unprotected sea 2 miles from land, and bringing them ashore, where they have been taken from the lighters and set up without the aid of powerful derricks, such as are commonly used for such work.

The country along our line was entirely without highways, or any means of communication. From the small settlement of San Juan del Norte to Ochoa the country was an unknown and uninhabited wilderness.

The company has gone to work in an unostentatious, systematic manner to accomplish the great work before them, and may well take pride in what has been accomplished.

Very respectfully,

FRANK P. DAVIS,
Division Engineer.

A. G. MENOCAL, Esq.,
Chief Engineer, Nicaragua Canal
Construction Company, America, Nicaragua.

SUMMARY OF HOSPITAL SERVICE.

NICARAGUA CANAL CONSTRUCTION COMPANY,
San Juan del Norte, Nicaragua, November 1, 1890.

The work first undertaken by the above company was simple surveying, carried on by small parties of engineers, who were constantly changing the location of their camps. During this period there was no regular organization of the medical department, and no hospital service. The health of the limited number of officers and men was cared for by three assistant surgeons, who traveled back and forth between the different camps in their different sections.

In the summer of 1889, much of the preliminary work having been completed, the number of employés was considerably increased, and the work more concentrated at several points, so that it became possible to inaugurate a hospital service.

At Greytown the hospitals of the company are located on the beach, about three miles from the town, and two medical stations have been erected on the San Juanillo and Deseado rivers. At the hospital two surgeons were employed, and also one in each station.

It has been the policy of this company to increase the hospital accommodations and number of the surgical staff as rapidly as was found necessary, either by the increase of the number of employés at work or from the possible increase of the percentage of sickness. A style of buildings has been adopted, which being made with corrugated iron sides and roofs, are practically exempt from danger by fire, and less liable than wooden buildings to become infected.

At present the company has at work about 2,000 men, and through the medical department furnishes the following accommodations:

(1) *Headquarters hospital* (on the beach at Greytown).—This hospital consists of three main buildings and nine smaller ones, as shown by the accompanying ground plan. No. 1 is occupied by the chief surgeon's office, the hospital office, and living quarters for the house surgeon and his assistant surgeons, the druggist, and chief surgeon's clerk. No. 2 has an operating room, arranged for antiseptic operations, and used solely for such cases; an examining room for the treatment of out patients, and examination of those desiring admittance to the hospital, etc.; a pharmacy, well stocked, and eight wards for the accommodation of officers and mechanics. Three of these wards are set aside as private rooms for the higher officials, or for cases requiring perfect quiet. No. 3 contains two large wards on each floor; one floor being used for surgical, and the other for medical cases among the laborers. No. 4 is divided into two large dining halls for the convalescent officers and laborers, respectively. No. 5 holds two closets and bath rooms for the use of officers; running water and shower baths being provided. No. 6 is used on the lower floor as a druggist's storeroom, while the upper floor is occupied by sleeping apartments. No. 7 has three rooms, viz., kitchen, steward's storeroom, and pantry. Nos. 8, 9, 10, 11, and 12 are respectively used as a drying house, laundry, barracks, deadhouse, and stables.

The wards throughout the hospital are furnished exactly as those in the best regulated hospitals of New York, while, owing to the mild climate, we have been enabled to provide more perfect ventilation than is possible in our large city hospitals.

A corps of well-trained nurses, under charge of a head nurse, care for the patients night and day, while the kitchen and general work about the buildings are looked after by a competent steward.

A house surgeon, two assistant surgeons, and an assistant druggist are employed here constantly. The capacity of this hospital is 125 beds.

An efficient ambulance service is connected with this hospital.

(2) *Temporary hospital No.* 1 (6 miles up the line of railway now building).—We have erected a building, 20 by 50 feet, for use as a temporary or emergency hospital, the object being to treat here mild cases from among the employés further up the line, and to furnish more immediate relief in cases of accident before forwarding patients to the headquarters hospital.

This building contains 30 beds, a pharmacy, and examining room. One assistant surgeon, an assistant druggist, and two nurses are located here.

(3) *Medical station.*—In addition to the hospital, we have established three medical stations; one in the Deseado Valley, one in the San Francisco Valley, and a third on the western division, in each of which is stationed an assistant surgeon. The duty of these doctors is to visit periodically all camps in the station, and, after treating such mild cases as they may find, to forward those requiring hospital treatment.

(4) *Druggist's department.*—The druggist is stationed at the headquarters hospital and receives and fills requisitions from the different camps and stations. He also has oversight of the pharmacies of both hospitals. Every camp, irrespective of its size and importance, is kept constantly stocked with a good assortment of the more common household drugs, while each camp, at which a surgeon is stationed, has a good pharmacy.

(5) *Sanitary work.*—It has been the policy of the company to prevent sickness as far as possible, and every surgeon is invested with the authority of a sanitary inspector in his station, and is expected to report every ten days to the chief surgeon as fully upon the sanitary conditions of the different camps, as upon matters more strictly medical.

At Greytown, during the summer months, every vessel arriving at the port is visited by the chief surgeon, or one of his staff, before communication with the shore is allowed.

The health of the employés has been very good. The care exercised by the company in looking after those actually ill has been followed by highly gratifying results. Only 1⅛ per cent. of those actually in the hospital have died, and this percentage includes all cases, whether due to accidents involving sudden death, or deaths from phthisis pulmonalis, contracted before entering the company's service.

Of those admitted to the hospital, suffering from diseases contracted in the country, only two-thirds of one 1 cent. has died. Diseases met with are not, as generally supposed, entirely of a malarial character, for only 51 per cent. of the cases treated during the three months past have been due to fever of any form.

Among the remaining, one finds about the same variety of troubles as in a more temperate climate.

J. EDWARD STUBBERT,
Chief Surgeon.

APPENDIX D.

THE MARITIME SHIP CANAL OF NICARAGUA.

INTEROCEANIC COMMUNICATION.

The question of interocanic communication, across the narrow neck of land which connects the North and South American continents, is one that has commanded attention since the discovery of the Western World. Indeed, it was the first question which that discovery suggested for solution; for this narrow neck of land is the only, but effectual, barrier which interposed to prevent the realization of Columbus's theory that the East Indies might be reached by sailing westward from Europe.

A history of the various attempts made to solve the problem, from the time of Charles V. of Spain until the present, would fill volumes and would be of greatest interest, but is foreign to the purpose of this pamphlet, which is to present as concisely as possible the practical results which thereby have been attained.

On the 15th March, 1872, a Commission, consisting of Brig. Gen. A. A. Humphreys, Chief of Engineers U. S. Army; Prof. C. P. Pattterson, Superintendent U. S. Coast Survey, and Admiral Daniel Ammen, Chief of Bureau of Navigation, was appointed by the President of the United States, in compliance with a resolution of the Senate, to consider the subject of communication by canal between the waters of the Atlantic and Pacific Oceans across, over, or near the isthmus connecting North and South America.

After a long, careful, and minute study of the several surveys of the various routes, and after additional surveys made in connection therewith, especially of the Panama and the Atrato-Napipi routes, the Commission reported February 7, 1876, unanimously, that the route from San Juan del Norte (Greytown) by way of the San Juan River, Lake Nicaragua, and the valleys of the Rio Del Medio and Rio Grande to the port of Brito on the Pacific coast, possesses greater advantages and offers fewer difficulties than any of the other routes shown to be practicable.

The different routes, surveys for which had been conducted through a series of years by naval officers under the instructions of the Navy Department, at this time considered and reported upon by the Commission, were as follows:

Named geographically from North toward the South the routes considered were:

1. The Isthmus of Tehuantepec.
2. The Nicaragua route via Lake Nicaragua.
3. The Isthmus of Panama.
4. The San Blas and Chepo route.
5. The Caledonia Bay and Morti routes.
6. The Caledonia Bay and Sucubti route.
7. The so-called "Du Puydt" route.
8. The Cacarica and Tuyra route.
9. The Atrato and Fernando route.
10. The Atrato-Napipi route.

Of the numerous projects for interoceanic communication by canal many had been proven impracticable and these only were deemed worthy of consideration. Exactly how many different routes had been proposed in 1876 can not be stated, but Admiral Davis in his work published in 1866 names nineteen as then suggested.

At the International Congress, convened in Paris in the year 1879 to determine the location of an interoceanic canal across the American Isthmus, the merits of the Nicaraguan route were ably advocated by the delegates from the United States Government, Admiral Daniel Ammen and Civil Engineer Menocal, and by other engineers of high repute. The correctness of the arguments then made in favor of this route, as well as of the report of the commission already mentioned has, since that time, been practically demonstrated. The only reason for the adoption of the Panama route by the congress was that it was believed that a sea-level canal could be there constructed. The abandonment of the sea-level theory, and the adoption of locks in 1887 has proven the fallacy of the theory.

CONCESSIONS AND ORGANIZATION.

In April, 1887, the Nicaragua Canal Association secured from the Government of Nicaragua a concession granting exclusive privilege to excavate and operate a maritime ship canal across its territory, from the Atlantic to the Pacific Ocean, for the unobstructed and commodious passage of vessels of the same size as the large steamers used for ocean navigation in Europe and America, with all privileges necessary to the advantageous and efficient prosecution of the work.

In pursuance of the conditions of the concession, surveys were commenced in December, 1887, and were continued by a numerous and competent corps of engineers until the final location of the route was determined. These surveys have been carefully examined and approved by a board of consulting engineers, and by the Nicaraguan Government, and they are the basis of all work done since the organization of the company of execution.

In February, 1889, the Congress of the United States granted to Frederick Billings and his associates, as incorporators, a charter under the name of The Maritime Canal Company of Nicaragua, with a capital of $100,000,000, and the right and authority to increase the same to $200,000,000.

In May, 1889, the incorporators organized under the provisions of their charter, and on the 25th of that month dispatched to San Juan del Norte, by the steamer *Alvena*, the first expedition for construction.

On the 3d day of June, 1889, the company began the preliminary work of construction at San Juan del Norte (Greytown).

On the 8th day of October following it commenced the work of excavation, and the Government of Nicaragua has officially recognized and declared by decree that the construction of the canal was formally commenced, in accordance with the terms of the concession, on the said 8th day of October, 1889.

WORK ACCOMPLISHED.

Since the 3d of June, 1889, the company has established permanent headquarters at San Juan del Norte, erected large storehouses, hospitals, dwellings, and other buildings. It has accumulated there several miles of piping and other material for the construction of an aqueduct to supply the lower portion of the canal and the harbor with pure fresh water. It has cleared of obstructions to navigation parts of the San Juanillo, the Deseado, the San Francisco, and other navigable streams. It has built over a mile of broad-gauge railroad, constructed over 70 miles of telegraph and telephone lines, and cleared several miles of the route of the canal between the harbor and the first lock in readiness for dredging. It has landed at San Juan del Norte large quantities of machinery, tools, lumber, piles, creosoted timber, boats, steam launches, lighters, and other material and equipment necessary in the work of restoring the harbor and for use in construction.

The important work of building the breakwater, to protect the harbor entrance from the effects of shifting sand on the coast, was commenced about the middle of December. The breakwater is now built out 600 feet, with a width of 40 feet, and the depth of water reached is about 15 feet. The result thus far attained by this work is most satisfactory, even exceeding the promises of the chief engineer in its effect upon the deposit of sand and upon the action of the ocean on the protected area.

DESCRIPTION OF COUNTRY.

The Republic of Nicaragua occupies a part of the American isthmus extending from about 10° 70′ N. to 15° N. latitude and from 83° 20′ W. to 87° 40′ W. longitude.

Its shores were first seen by Europeans in 1503, when Columbus in his fourth voyage rounded the cape at its northeast angle, which he called Cape Gracias á Dios, the name it bears to-day, and then coasted south along its entire eastern shore. In 1522 Gil Gonzales d'Avila discovered its Pacific coast, and penetrated to the lakes and to the cities of its Indian inhabitants. Previous to this the country was undoubtedly occupied by a numerous population of Aztecs, or nearly allied people, as numerous specimens of pottery, gold images, and implements found about the lakes and their islands seem to demonstrate.

In 1529 the connection of the lakes with the Caribbean Sea via the River San Juan was discovered, and during the last quarter of that century considerable commerce was carried on by this route between Granada and other ports of Lake Nicaragua and the cities of Nombre de Dios, Carthagena, Havana, and Cadiz.

In 1823, Nicaragua with her sister colonies, threw off the rule of Spain and formed a confederation; this confederation was dissolved in 1839, and since then Nicaragua has conducted her own affairs.

In shape, Nicaragua is an irregular quadrilateral. Its longest side extends from the Gulf of Fonseca northeasterly to Cape Gracias á Dios., 290 miles. From Cape Gracias á Dios south to the mouth of the Rio San Juan, the Caribbean coast line is 250 miles long; thence nearly due west across the Isthmus to Salinas Bay, on the Pacific, is 120 miles. The Pacific coast line, extending northwest, is 160 miles long. The area of the country is 51,600 square miles. In point of size it stands first among the Central American Republics. It is larger than either the State of New York or the State of Pennsylvania; it is about the size of Denmark, Belgium, the Netherlands, and Switzerland, combined; and is one-fourth as large as France or Germany. Its population is about 400,000.

The principal cities are—

	Inhabitants.
Leon	30,000
Granada	12,000
Managua	10,000
Rivas	8,000
Massaya	14,000

The Gulf of Fonseca and Salinas Bay, at the northwest and the southeast points of the Pacific coast of Nicaragua, are two of the finest and largest harbors on the entire Pacific coast of Central America. About midway between them is another fine harbor, that of Corinto; and at various places along the coast, at Tamarindito, Brito, and San Juan del Sur, are good anchorages, secure in all except heavy southwest gales. On the Caribbean coast there are no natural harbors suitable for large vessels, but there are numerous lagoons, bights, and river mouths, affording the best of shelter for coasting vessels and steamers.

The central portion of Nicaragua, from north to south, is occupied by the main Cordillera of the isthmus, which is here greatly reduced in altitude and consists of a confused mass of peaks and ridges with an average elevation of scarcely more than 1,000 feet.

Between this mountainous region and the shore of the Caribbean Sea stretches a low, level country covered with dense forests and drained by several large rivers.

West of the mountain zone is a broad valley extending from the Gulf of Fonseca, southeasterly, to the boundary of Costa Rica—in this valley are located the two lakes, Managua and Nicaragua. The latter, over 100 miles long and from 30 to 60 miles wide, is worthy of being called an inland sea; Lake Managua, which flows into it from the northwest, through the river Tipitapa, is 30 miles long and about 20 miles wide.

Between these lakes and the Pacific is a narrow strip of land from 30 to 12 miles in width, stretching from the magnificent plain which surrounds the cathedral city of Leon, in the north, to the rolling fields of indigo and maize and the cacao plantations which environ the garden city of Rivas, in the south. The beauty, fertility, and salubrity of this region is the theme of universal praise; its undulating surface becomes hilly near the Pacific and within a few miles of the ocean breaks into the coast range, from 500 to 1,200 feet in height. Looking from the summit of one of the western hills the garden of Central America, containing the city of Rivas and half a dozen small towns and villages bowered in orange groves and palms and surroundedby plantations of sugar, indigo, and cacao, lies spread below.

The drainage of the lakes and of all this region passes down the Rio San Juan and discharges into the Caribbean Sea at San Juan del Norte, the southeast limit of the country. On the western shore of Lake Nicaragua nearly opposite the head of the San Juan is the lowest pass across the backbone of the New World, from the Arctic Ocean to the Straits of Magellan.

CLIMATE.

In its climatic features Nicaragua is exceptionally favored. Lying between the elevated mountain masses of Costa Rica on the south and of Honduras on the north, the average elevation of its own mountains is hardly 1,000 feet; it is thus the natural thoroughfare of the northeast "Trades," which rush in from the Caribbean Sea, sweep across the eastern slopes, break the surface of its lake into sparkling waves and then disappear over the western hills, aërating, cooling, and purifying the entire country, destroying all germs of disease, and making Nicaragua the healthiest region in Central America.

On the Atlantic slope rains are frequent, but by the time the wind reaches the lake basin its surplus moisture is gone, and as the drier land raises its temperature it absorbs instead of depositing moisture. Hence a difference in climate between the east and west sides of the country, the latter being, in the dry season, from November to May, almost without rain. Squier says of this season:

"The temperature is less, the nights positively cool and the winds occasionally chilling. The sky is cloudless and trifling showers fall at rare intervals. * * * This season is esteemed the healthiest of the year. Its effect is practically that of a northern winter."

The temperature of Nicaragua is equable. The extreme variation recorded by Childs was 23°; observed near the head of the San Juan in May, 1851. It may be said in general terms, that the temperature rarely rises above 90° Fahr. or falls below 70° Fahr. The average temperature, as observed by the latest surveying party on the San Juan River, was 73° at 6:30 a. m., and 82° at 2 p. m. The equatorial cloud belt, following the sun north in spring, is late in reaching Nicaragua, and the wet season is shorter than in regions farther south. The average rainfall west of the lakes for nine years was about 64½ inches. On the Caribbean coast it is greater.

The scenery of the eastern portion of Nicaragua is of the luxuriance peculiar to all tropical countries. In the vicinity of the lakes and between them and the Pacific, the isolated mountain peaks which bound the plain of Leon on the northeast, the mountain island of Ometepe and Madera, in Lake Nicaragua, the towering masses of the Casta Rican volcanos and the distant blue mountains of Segovia and Matagalpa seen across the sparkling waters of the lakes, charm the eye with scenic beauties unsurpassed in grandeur, variety, and richness of coloring in any other country.

PRODUCTS.

The products of Nicaragua are numerous and valuable, although the resources of the country are as yet almost entirely undeveloped. In the hilly region of the northwest coffee is grown in large quantities. Brazil wood grows in abundance in the forests, and plantations of sugar, indigo, and cacao abound everywhere between the lakes and the Pacific. Potatoes and maize thrive in the uplands of Segovia. The Chontales region, east of the lake, is a grazing country supporting thousands of cattle. Farther east are the gold and silver mining districts of La Libertad, Juigalpa, and others not so well known. The dense forests which cover portions of the country are rich in rubber, cedar, mahogany, and dye woods, and trees and plants, too numerous to mention, of medical and commercial value.

All tropical fruits grow in abundance, and the rich banks of the rivers of the eastern slopes will yield almost incalculable harvests of plantains, bananas, oranges, pineapples, and limes.

Game of numerous varieties—deer, wild hog, manatee, tapir, wild turkey, ducks, quail, etc.—is plentiful in the forests, and fish abound in the rivers.

LOCATION OF ROUTE.

It is through this country, salubrious, fertile, beautiful, and rich in natural resources that the Maritime Canal of Nicaragua is to be constructed. Its route, as determined by surveys, accepted and approved by the Nicaraguan Government, traverses the lowest depression of land in the Cordillera, between the Arctic Ocean and Cape Horn. The depression is occupied by the large inland sea of fresh water, Lake Nicaragua, and by its outlet, the San Juan River. The western border of the lake is within 12 miles of the Pacific coast, from which it is separated by a low divide of 42 feet. Its surface is 110 feet above sea level. Its drainage is toward the Atlantic, through the San Juan River into the Caribbean Sea. These great natural features are to be utilized in the proposed canal. The lake is 100 miles long, has an average width of 45 miles and a variable depth, reaching in some places 150 feet. The San Juan River is already navigable for river and lake craft throughout most of its length.

WORK PROPOSED.

The details of work as proposed are briefly, a breakwater at San Juan del Norte and the deepening of the harbor, dredging thence to the westward 9¼ miles through alluvial ground; then a lock of 30 feet lift. At 1¼ miles beyond there will be a second lock of 31 feet lift, and a dam across the small stream Deseado, above which will be two basins, separated by another dam and a third lock of 45 feet lift, affording 5 miles of free navigation; then a rock cut about 2⅞ miles in length, followed by 12 miles of free navigation in the valleys of two small rivers, the San Francisco and the Machado. Here the water will be raised by dams and embankments, forming basins which will connect directly with the San Juan above a large dam across that river, which will raise the surface level in the river and lake and secure additional free navigation of 64½ miles in the river and 56½ miles across the lake. On the western side of the lake the canal enters a cut of slight depth, in earth and rock, 9 miles long, issuing thence into the Tola basin, with 5¼ miles of free navigation obtained by damming the small stream, the Rio Grande. At this dam a series of locks lowers the level 85 feet, and the canal proceeds in excavation down the valley of the Rio Grande, a distance of 2 miles, to the last lock, a tidal lock of 20 to 30 feet lift, below which the canal enters the upper portion of the Harbor of Brito, 1½ miles from the Pacific Ocean, where a breakwater will be constructed, enlarging and making more commodious the present harbor.

GENERAL FEATURES OF WORK.

The general features of the work as determined by the surveys and studies previously referred to are as follows:

	East side.	West side.	Total.
	Miles.	*Miles.*	*Miles.*
Sea-level canal, dredged in earth, from the coast	9.297	0.57	9.867
Rock thorough cuts, with or without earth on top	2.833	6.41	9.243
Earth thorough cuts, no rock	2.146	2.42	4.566
Earth with layer of rock at bottom	.354	2.00	2.354
Total cutting, apart from locks	14.630	11.40	26.030
Locks, three on each side	.379	.380	.759
Natural surfaces, flooded to 30 feet depth or over, requiring neither dredging nor excavation	13.649	4.53	18.179
Flooded surfaces, requiring earth dredging only to make 30 feet depth of water	2.70	.74	3.440
Channels in lake and river requiring excavation under water	35.00	2.28	37.280
Natural courses or artificial basins having 30 feet or over of water and requiring neither dredging nor excavation	43.67	40 09	83.760
Total route from ocean to ocean	....	....	169.448

SUMMARIES.

	Miles.
Natural and artificial water ways, needing neither dredging nor excavation	101.939
Canal proper, thorough cuts	26.030
Excavation below surface of water to give 30 feet depth of water, chiefly earth	40.720
Six locks	.759
Total route from ocean to ocean	169.448

	East side.	West side.	Total.
	Miles.	*Miles.*	*Miles.*
Navigation in canal and locks	15.009	11.780	26.789
Free navigation in basins	....	....	21.619
Free navigation in river San Juan	....	....	64.54
Free navigation in Lake Nicaragua	....	....	56.50
Total route from ocean to ocean	....	....	169.448

The entire route has been carefully located and cross-sectioned and the computed quantities of excavations, fills, and embankments as determined by these studies are as given below. Borings by rock drills, to the depth of necessary cuttings, have been made throughout the entire length of the divide cuts, and the material is everywhere found to be of rock that will hold well the slopes proposed.

Quantities.

	Cubic yards.
Earth dredging for canal, all below sea level	29,823,161
Earth excavation, all above sea level	21,773,810
Rock excavation	13,452,938
Rock excavation, under water	575,445
Total excavation, earth and rock	65,625,354
Rock fills, for dams and breakwater taken from divide cuts	4,033,810
Earth fills, taken from excavations	6,105,380
Concrete	615,651
Stone pitching	202,641

It is estimated that construction can be completed and the canal ready for operation by 1897.

The minimum depth of water throughout the canal will be 30 feet.

With the exception of the rock cuts in the eastern and western divides, excavation will be at all points wide enough for two ships to travel in opposite directions. Through the basins and in the lake and river San Juan vessels can pass each other and navigate with entire freedom.

CAPACITY FOR TRAFFIC.

The capacity of the canal for traffic will be limited only by the time required to pass a lock. On the basis of 45 minutes as the time consumed in the operation and that but one vessel will pass in each lockage, the number of vessels which may pass through the canal in one day is calculated at 32, or, in one year, 11,680; which, based on the average tonnage of vessels going through the Suez Canal, will give an annual capacity for traffic of over 20,000,000 tons, but the locks are 650 feet long and 70 feet wide in the chamber, and two vessels, each of 2,000 tons displacement, may be passed through on each lockage, thus largely increasing, if not doubling, the estimated capacity. The present traffic of the Suez Canal is about 7,000,000 tons per annum, with a transit of about 3,500 vessels.

The lowest flow of the lake in the dry season is 11,390 cubic feet per second. Its average discharge is 14,724 cubic feet per second, or in one day 1,272,530,600 cubic feet. The water required for 32 lockages in one day is 127,400,000 cubic feet; consequently the lake supply alone is ten times the maximum needed for the operations of the canal.

The time consumed in passing from ocean to ocean, by steamers, is estimated at twenty-eight hours, which includes one hour and twenty minutes for possible detentions in narrow cuts.

That the capacity of the canal, and the sufficiency of the supply of water for lockage, are fully adequate to any demands likely to be made by commerce for some time to come is evident. In this connection some estimate of the probable business of the canal is proper. The great increase of navigation by steam during the past twenty years is an important factor in this problem. The substitution of steam for sail since 1870 is indicated in the following tables:

Shipping tonnage of the world.

Year.	Sail.	Per cent.	Steam.	Per cent.
1870	13,868,000	88	1,918,000	12
1881	15,002,000	72½	5,644,000	27½
1888	9,497,000	45	11,552,000	55

This, however, is not a proper indication of the comparative increase for, owing to the greater speed of steamers as compared with sailing vessels, their capacity for transportation is multiplied five fold, and the comparison by percentages then appears as follows:

	1870.	1881.	1888.
	Per cent.	*Per cent.*	*Per cent.*
Sail transportation	59	34½	14
Steam transportation	41	65½	86

This enormous change is illustrated, as well as anywhere, in the growth of tonnage passing though the Suez Canal in the same years:

	1871.	1881.	1888.
Number of vessels	765	2,727	3,440
Tonnage	761,467	4,136,779	6,640,834

These figures are indicative of the eagerness with which commerce avails itself of every facility that expedites the movement of commodities and shortens the time of transportation, whether it be by rapidity of locomotion or by lessening of distances, thereby lessening its cost They also indicate the wonderful growth of commerce under favoring circumstances.

Under such circumstances the commerce of the world, as indicated in the first table, has increased threefold in eighteen years. The effective tonnage, allowing fivefold for steam, was—

	Tons.
1870	23,458,000
1881	43,222,000
1888	67,257,000

If it increases in the same ratio for the next seven years in which it advanced between 1881 and 1888, it will in 1895 amount to 105,000,000 tons.

TONNAGE TRIBUTARY TO THE CANAL.

From statistical records it appears that the number of ships trading from our Eastern ports and from Europe to the North and South Pacific was, in 1879, 2,647, with an aggregate tonnage of 2,671,886 tons.

Eight years later, in 1887, statistics show the following facts:

	Tons.
Trade across the Isthmus of Panama	1,217,685
Trade between Atlantic and Pacific ports of the United States	145,713
Trade between Atlantic ports of the United States and foreign countries west of Cape Horn	752,585
Trade between Pacific ports of the United States and foreign countries east of Cape Horn	879,844
Trade around Cape Horn of European countries (Austria, Denmark, Norway, Sweden, and Russia, not included, as statistics are not accessible).	1,471,399
Trade of British Columbia with Europe	39,818
	4,507,044

Excepting the trade across the Isthmus, this is all trade around Cape Horn. No estimate is made of the trade around Cape Good Hope, much of which would seek the canal if it were open ; nor is any estimate made of the trade which, rather than break bulk for transport by the transcontinental railways, would continue on shipboard when the question of the long voyage around either cape had resolved itself into that of a passage through the canal.

These statistics show that the traffic which would naturally seek the canal was, in 1879, 2,671,886 tons, and that it had increased in 1887 to 4,507,044 tons, the percentage of increase being nearly 69 per cent. A similar increase in the next eight years would make it in 1895, 7,616,904 tons. And there is no reason why such an increase should not be realized; in fact, every reason exists to expect it; the industrial development of our Pacific States, the settlement of Alaska, the growing importance of Chili, and, not least of all, the evident disposition of the enterprising and wealthy Empire of Japan to become a dealer in the markets of the world, assure it.

In the foregoing estimates no account whatever is taken of vast sources of traffic, such as ores and timber, of which practically there is nothing carried now, but which will furnish an enormous tonnage as soon as facilities for transportation are provided.

The natural growth and development of the Pacific States and Territories will furnish thousands of tons of traffic to the canal for the hundreds that exist under present conditions. The lumber trade of Oregon and Washington presents the most notable development of any line of commerce that can be cited. In 1886 the total shipment was 6,000,000 cubic feet; in 1887 it amounted to 48,000,000 feet; the amount cut in 1888 is estimated at 706,985,000 feet, and its value at $7,750,000. The shipments abroad of lumber from Puget Sound were valued at over $5,000,000. It is estimated that the forests of Washington contain not less than 175,000,000,000 feet of uncut yellow and red fir, and the timber field of Oregon is 25,000 square miles, a quarter of the superficial area of the State. William H. Seward said: "The entire region of Oregon, Washington Territory, British Columbia, and Alaska seems destined to become a shipyard for the supply of all nations." Lumbermen in Washington estimate that the opening of the Nicaragua Canal will add $2 to the value of every thousand feet of lumber standing around Puget Sound, and the same is true of the still larger timber fields of the Alaskan Archipelago, the estimate being based on cheap transportation, for the cost of ocean transportation as compared to railroad is as 1¼ to 10.

The wheat, lumber, fish, wool, furs, and other commodities of the Pacific Northwest will be provided to commerce in increasing quantities and with greater profit to producers when cheap water transportation is at hand to convey them promptly ***to the world's markets.***

The trade between Australia and our Atlantic ports has quadrupled since 1885, though it is still trifling in comparison with the total foreign commerce of those colonies, but it has grown to what it is without encouragement and in spite of obstacles and disadvantages, and favoring circumstances would open up for us large possibilities with this young and vigorous English-speaking people, whose foreign commerce already exceeds $600,000,000 per year.

The total tonnage entered and cleared at New Zealand ports in 1885, exclusive of coasters, was 1,032,700 tons, mostly by sail to Europe.

The distance from Auckland, New Zealand, to Liverpool is 1,100 miles less by Nicaragua than by any other route. From Melbourne it is 400 miles less, and from Sydney 500 miles less, with more favorable weather and winds and currents.

From Yokohama the saving is 3,900 miles and over.*

A London journal says: "In estimating the future before a waterway connecting the Pacific and Atlantic, it must be remembered that India has now 7,250,000 tons of shipping annually clearing from her ports, Australasia, 16,000,000, Hong Kong, 7,000,000, and the Straits Settlements, 7,000,000, most of which comes to Great Britain, and a very large part of which would find its way through the Nicaragua Canal, but incalculable as the advantages would be to this country (Great Britain), it is probable that the United States would benefit to a still greater extent. That this is so is clear from the fact that the greater part of the huge commerce of that country would be saved, through using the canal, sometimes between 5,000 to 12,000 miles of travel.* But economy of time and distance is not the only thing deemed of consequence by commerce.

Breaking bulk in transit is also a cost to be eliminated if possible. Manchester is to-day building, at a cost of $35,000,000, a ship canal 35 miles long to the estuary of the Mersey, when Liverpool, her natural port, is only 31½ miles distant by rail, in order to avoid making and breaking bulk away from home and that she may save to her merchants some part of the charges and commissions paid to Liverpool shipping agents.

COASTING TRADE OF THE UNITED STATES.

One most important feature is yet to be mentioned. The opening of the canal will practically make our coast line continuous from Maine to Alaska, and our coasting trade will thereby receive an impetus that can hardly be overestimated. It already amounts to over 500,000 tons per annum between our Atlantic and Gulf ports and Central America and Colombia. Galveston, New Orleans, Mobile, Pearl River, Pensacola, Savannah, Brunswick, Beaufort, Wilmington, Norfork, Baltimore, Philadelphia, New York, and Boston are all interested in the total.

Steamers built for the purpose trade along the shores of the Caribbean Sea, exchanging our articles of commerce for the products of the tropics; but the best harbors and the richest districts and most valuable products of these neighbors of ours are on the Pacific side, where our vessels can not reach them, so they fall to the British and other steamers that ply on the west coast, and the trade goes to Europe.

When the opening of the canal shall have enabled the little steamers and coasting schooners to push through to the Pacific side and compete for its rich trade, with the advantage of home ports and markets thousands of miles nearer than those of Europe, it will not be long before our coasting trade shall have grown to many times its present volume. These are conditions which will tend to make San Francisco, on the Pacific and New York on the Atlantic the markets of the world, and the United States, situated as it is between the two oceans, with practically an endless coast line, the mistress of its commerce.

To this possibility the geographical location and natural features of the Nicaragua Canal are most advantageous, and Lake Nicaragua—the summit level of the canal, a mighty body of fresh water 100 miles in length by 45 in width, deepening to 150 feet, swept continually by the trade winds, with a delightful and healthy climate—gives to the route a political and international importance unique and significant. The nation that controls this canal under terms of amity with Nicaragua will here find rest and refreshment for its fleets and a *point d'appui* from which either ocean may readily be reached in case of need.

To this sheltered stronghold its squadrons, after service done on either ocean, at the bidding of a telegraphic sign from the home Government may return to refit and rest in absolute security until some renewed need of action calls again for their services. There can not be imagined a more potent means of avoiding difficulty than such efficient preparation in advance to quiet promptly any disturbances which may arise.

Placed thus advantageously, one fleet would readily do the work of two, and with a naval depot thus conveniently located, the Pacific Coast and our Alaskan possessions, as well as our commerce on both oceans, would be as well guarded as our Atlantic Coast.

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* See Appendix A.

This, however, is merely incidental to the canal as an American enterprise and a reason outside of financial considerations why it should command American support.

THE GATEWAYS OF COMMERCE.

When the Nicaragua Canal is built it will stand at the gateways of commerce on the Western Continent, as Suez does in the East, to take toll of more than one-half of the commerce of the world. It needs no argument to demonstrate what that means. The annual reports of the Suez Canal, which possesses far less than a moiety of the natural advantages of the Nicaraguan enterprise, are its best illustration.

We subjoin that portion of the reports since 1879 which has direct bearing upon the subject before us.

Traffic of the maritime canal of Suez.

Year.	No. of ships.	Net tonnage.	Passengers.	Receipts from tolls and passengers.
1879	1,477	2,263,332	84,512	$5,595,247
1880	2,026	3,057,421	101,551	7,501,627
1881	2,727	4,136,779	90,524	9,619,826
1882	3,198	5,074,808	131,068	11,346,345
1883	3,307	5,775,861	119,177	12,350,052
1884	3,284	5,871,500	151,916	12,029,585
1885	3,624	6,335,752	205,951	12,423,354
1886	3,100	5,767,655	171,411	11,297,038
1887	3,137	5,903,024	182,997	11,565,054
1888	3,440	6,640,834	193,895	12,975,315
Expenses of operation, etc., for 1888:				
For administration				307,914
For operation				521,137
For maintenance and renewals				378,007
				1,207,058

The company has not yet published a report for 1889.

From this report is to be seen at a glance the tribute which commerce willingly pays to facilities for its more commodious transaction and its steady and continuous growth under such conditions.

ESTIMATED INCOME.

In view of all the conditions it is not excessive; indeed it is most moderate to expect for the Nicaragua Canal, when it shall be opened to the traffic of the world in 1897, a tonnage of not less than 7,000,000 tons ready for transit. Now, 7,000,000 tons, at $2.50 per ton, a moderate tariff, means a revenue of $17,500,000 per annum.

The operating expenses would for many reasons be less than at Suez, but allowing them to be the same, say, $1,200,000, we may say that the net revenue would pay 5 per cent. on $325,000,000, with the probability of greatly increasing even the selarge figures.

APPENDIX A.

Table showing distances in miles between commercial ports of the world and distances saved by the Nicaragua Canal.

From—	Via Cape Horn.	Via Cape of Good Hope.	Via Nicaragua Canal.	Distance saved.
	Miles.	*Miles.*	*Miles.*	*Miles.*
New York to—				
San Francisco	14, 840	....	4, 760	10, 080
Bering Strait	16, 100	....	7, 882	8, 218
Alaska	15, 300	....	6, 682	8, 618
Acapulco	13, 071	....	3, 122	9, 949
Mazatlan	13, 631	....	3, 682	9, 949
Hong-Kong	18, 180	15, 201	11, 038	4, 163
Yokohama	17, 679	16, 190	9, 363	6, 827
Melbourne	13, 502	13, 290	10, 000	3, 290
New Zealand	12, 550	14, 125	8, 680	5, 445
Sandwich Islands	14, 230	....	6, 388	7, 842
Callao	10, 689	....	3, 713	6, 976
Guayaquil	11, 471	....	3, 053	8, 418
Valparaiso	9, 750	....	4, 700	5, 050
New Orleans to—				
San Francisco	15, 052	....	4, 047	11, 005
Acapulco	13, 283	....	2, 409	10, 874
Mazatlan	13, 843	....	2, 969	10, 874
Guayaquil	11, 683	....	2, 340	9, 343
Callao	10, 901	....	3, 000	7, 901
Valparaiso	9, 962	....	3, 987	5, 975
Liverpool to—				
San Francisco	14, 690	....	7, 508	7, 182
Acapulco	11, 921	....	5, 870	7, 051
Mazatlan	13, 481	....	6, 430	7, 051
Melbourne	13, 352	13, 140	12, 748	392
New Zealand	12, 400	13, 975	11, 349	2, 626
Hong-Kong	18, 030	15, 051	13, 786	1, 265
Yokohama	17, 529	16, 040	12, 111	3, 929
Guayaquil	11, 321	....	5, 890	5, 431
Callao	10, 539	....	6, 461	4, 078
Valparaiso	9, 600	....	7, 448	2, 152
Sandwich Islands	14, 080	....	9, 136	4, 944
Spain to Manilla	16, 900	13, 951	13, 520	431
France to Tonquin	17, 750	15, 201	13, 887	1, 314
Hamburg to—	13, 931	....	6, 880	7, 051
Mazatlan				
Acapulco	13, 371	....	6, 320	7, 051
Fonseca	11, 430	....	5, 530	5, 900
Punta Arenas, Costa Rica	11, 120	....	5, 515	5, 605

From—	To eastern entrance of Nicaragua Canal.	From—	To western entrance of Nicaragua Canal.
	Miles.		*Miles.*
New York	2, 021	New Orleans	1, 308
Liverpool	4, 769	San Francisco	2, 578
Hamburg	5, 219	Valparaiso	2, 518
Amsterdam	4, 994	Callao	1, 531
Havre	4, 874	Portland	3, 219
Cadiz	4, 220	Victoria	3, 428

NOTE.—The distances have been measured by customary routes most convenient for sailing ships and slow freight steamers.

APPENDIX E.

NICARAGUA CANAL.

THE NICARAGUA CANAL PROJECT.

[From Engineering News, September 14, 1889.]

It has been evident for some time to the careful observer that, although the day of small canals is over, the day of great ship canals is just dawning. Heretofore, although there has always been as great proportional need as now for ship canals to shorten sailing distances, yet the means for construction, both mechanical and financial, were so much more limited, and the aggregate volume of traffic to be accommodated so small, that there was not enough traffic "in sight" to pay interest on a cost necessarily far greater than it is to-day.

Accordingly we find that, although ship canals at Suez, Panama, Nicaragua, Corinth, Cape Cod, and elsewhere have been talked about for centuries, yet it is only within the last three decades that the first of them, that at Suez, has really been completed and put to use. At the present moment there are a dozen or so of them in various parts of the world which either are or are likely soon to be under way, as we may show more fully before we close.

This is but the natural effect of the great change of conditions alluded to, and it is important to remember that the end is not yet in this change, great as it is. Capital is so cheap that interest is less than half what it was twenty years ago; engineering appliances are so improved that the cost in labor and time of executing great public works is certainly not more than half what it was twenty years ago; commerce has multiplied with even more marvelous rapidity. The railway mileage of the world has doubled since 1875, or in fourteen years, and that of the United States has doubled since 1877. The shipping has multiplied in the still more marvelous ratio shown in the table below:

Shipping tonnage of the world.

	1820.	1840.	1860.	1870.	1881.	1888.
Sail	3,140,000	4,560,000	9,586,000	13,826,000	15,002,000	9,497,000
Steam	6,000	116,000	820,000	1,918,000	5,644,000	11,552,000
Total	3,146,000	4,676,000	10,406,000	15,576,000	20,646,000	21,049,000
Total effective	3,170,000	5,140,000	13,686,000	20,646,000	43,222,000	67,257,000
Equivalent per cent. per decade.	....	27.3	63.2	50.9	95.8	88.1

[The "effective" tonnage is ascertained by multiplying the steam tonnage by 5, and adding the product to the sailing tonnage, steamers making about five times as many voyages per year as sailing vessels. The percentages in the last line gives the correct *decennial* ratio regardless of the actual period between the figures.]

It is but natural that great enterprises which lagged along hopelessly in the '40's, '50's, and '60's, should now be begun with confidence, and it is quite certain that enterprises of any promise, which even now are neglected, will not be likely to be neglected long. For example, we can hardly expect the Nicaragua Canal to be opened before 1895, or seven years from 1888. In view of the above accelerating ratio up to 1888, what is the commerce of the world likely to have grown to when it is opened? Obviously it will be vastly larger than it is now, and that is enough for our present purpose; but we should bear in mind also that the commerce tributary to it is the most vigorously growing in the world. Perhaps, however, as giving a more direct indication of how traffic tends to multiply, we may as well give here the following table of the growth of traffic of the Suez and Sault Ste. Marie canals since they were opened to commerce, the enormous jump in the "Soo" traffic in the last year being especially notable:

Transit through Suez Canal.

Year.	No. of vessels.	Net tonnage.	Receipts from tolls.	Average toll.
1870	486	436,609	$869,152	$1.99
1871	765	761,467	1,519,077	1.99
1872	1,082	1,160,743	2,875,418	2.47
1873	1,173	1,367,767	4,170,145	3.04
1874	1,264	1,631,650	4,533,558	2.77
1875	1,494	2,009,984	5,286,158	2.64
1876	1,457	2,096,771	5,526,292	2.63
1877	1,663	2,351,447	6,036,186	2.57
1878	1,593	2,269,678	5,669,134	2.49
1879	1,477	2,263,332	5,426,223	2.39
1880	2,026	3,057,421	7,298,524	2.43
1881	2,727	4,136,779	9,438,776	2.28
1882	3,198	5,074,808	11,086,208	2.18
1883	3,307	5,775,861	12,111,698	2.09
1884	3,284	5,871,500	11,725,752	2.00
1885	3,624	6,335,752	12,011,452	1.89
1886	3,100	5,767,655	10,954,215	1.89
1887	3,137	5,903,624	11,199,060	1.89
1888	3,440	6,640,834	12,607,524	1.89

[Receipts are computed at 5 francs per dollar. Net tonnage is about 70 per cent. of the gross tonnage.]

Transit through Sault Ste. Marie Canal.

Year ending—	Days open for navigation.	No. of vessels.	Net tonnage.	Operating expenses.
1881	198	3,304	1,802,571	(*)
1882	229	4,676	2,379,210	$28,854
1883	216	4,163	2,130,181	35,510
1884	233	4,768	2,540,799	31,213
1885	219	5,629	2,981,786	27,242
1886	222	6,203	3,701,014	25,401
1887	218	7,926	4,882,802	22,139
1888	210	8,823	5,581,169	29,899
1889	....	8,832	6,932,203	....

* Not at hand.

[The first Sault Canal was finished in 1855, at a cost of $999,802. The above statistics begin with the opening of the new canal.]

On the other hand, from the accompanying little diagram which we reproduce from our issue of April 27, 1889, it will be seen that the greatest *small* canal in the world by far, in every sense, has been steadily falling off in traffic since 1873, and is now even smaller than it was in 1862, when it was larger than ever before.

We need not seek far for a reason. It lies in the simple fact that the railways have distanced the small canals, not only in speed, but in actual cost of transportation, while they still lag far behind large ships and steamers in economy of transport, and to all appearance must ever do so. The most cursory examination of rates and cost of transportation will reveal this fact. The following table of lake and canal rates is perhaps alone sufficient, remembering that what may be called the standard all-rail rate between Chicago and New York is 30 cents per 100, or a trifle over 0.60 cents per ton per mile, which rate is often severely cut, sometimes by half or two-thirds. As the average cost per ton per mile of the whole United States was just about 0.6 cents (for 109 miles average haul) we may be quite certain that the fair proportional cost of hauling such freight by rail is little if any over 0.3 to 0.4 cents per ton per mile. On the other hand, the ocean rates on grain to Liverpool last year ranged from 2 to 9 cents per bushel of 60 pounds, or a 3,000-mile haul, averaging about 5 cents, or 0.055 cents per ton per mile. At 0.1 cent per ton per mile the steamers feel that they are doing very well, even on flour, which stands about 50 per cent. more per ton than wheat.

Lake and canal rates on wheat.

[Per ton of 2,000 pounds.]

	1885.	1886.	1887.	Average.	Miles.	Per mile.
						Cents.
Chicago to Buffalo, lake	$0.67	$1.22	$1.37	$1.09	925	0.118
Buffalo to New York, canal	1.28	1.67	1.46	1.47	494	0.298
Chicago to New York	1.95	2.96	2.83	2.56	1,413	0.181
Chicago to Oswego	1.05	1.96	2.54	1.85	1,060	0.174
Oswego to New York	1.16	1.52	1.30	1.31	367	0.357
Chicago to New York, via Oswego	2.16	3.47	3.84	3.16	1,427	0.221
Chicago to Montreal	1.97	2.47	2.83	2.42	1,348	0.179

Contrast these figures (all for net tons of 2,000 pounds) with the figures given below of lake and canal rates. We see at once that in a rude way we may classify the lowest feasible rates of freight as follows, with at least relative correctness:

Long haul rates, bulk freights (in cents per ton mile).

Small canals (about)	0.4
Rail (about)	0.3+
Erie canal (about)	0.3—
Lake, 14 to 16 feet draught (about)	0.12
Ocean, 25 feet (about)	0.05+

In evidence of why this difference should exist let us compare one or two items: It has been aptly said, in relation to coal economy in marine steam-engines, that if we assume paper to be as good fuel as coal per ton, we have only to "burn this letter" of one-half ounce weight to propel a ton a mile by steamer—in other words, a ton of 2,000 pounds will produce 64,000 ton-miles of ship and cargo on the ocean at freight speeds. The same is frequently realized by the best lake vessels. To propel one mile a freight-car weighing, with load, 25 tons takes, on an average, over 5 pounds of coal, so that on land a ton of 2,000 pounds only produces 10,000 ton-miles of car and load, or say one-seventh as much. Again, a ship costs only some $50 per ton, a steamer some $100 per ton, and that steamer ton will be good for some 60,000 ton-miles per year, or 600 ton-miles yearly per dollar of capital invested. Were railways equally effective per dollar of investment the 81,000,000,000 ton-miles and passenger-miles made last year in the United States would represent a capital investment of only $135,000,000. They actually represent a capital of $9,607,000,000.

It is needless to go further. The demand of the age being for quick and cheap transportation, we see at once why the day of great ship canals is so visibly dawning. It is dawning, not only for canals, which save great sailing distances, like the Suez and Nicaragua, but also for canals like the Manchester, which save no distance whatever, but merely compete with railways, saving the disadvantage of breaking bulk. That canal is to be 35 miles long, 26 feet deep, 120 feet wide, and to cost, if it uses up all its authorized capital, some $49,000,000. Its actual cost will be at least $35,000,000. Yet Manchester is a city of only 350,000 people, and the tonnage to be benefited by the canal, although as yet largely problematical, is certainly small compared with that which will be tributary to the Nicaragua canal, while the dues must be trifling in comparison.

At least one other canal like the Manchester is likely to be soon started in England: but of course the greatest stimulus to ship canal construction is when more or less sailing distance is also saved, as in the Corinth, North Sea, and Baltic, Cape Cod, and half a dozen others now under way or likely soon to be. And of all canals which ever can be built, it needs only a glance at the map to see that the Nicaragua, or other canal through the Central American Isthmus will save the greatest sailing distances. Even the saving by the Suez Canal is small in comparison.

Thus between London and Canton the Suez saves 3,300 miles (10,000 against 13,300); to Bombay it saves 4,325, and to Calcutta, 3,626 miles, the average saving being about 3,500 miles, while the Nicaragua canal saves from 5,000 to 8,000 miles on most of the voyages likely to be required. Between London and San Francisco it saves nearly 7,200 miles out of a voyage of 14,700; between New York and San Francisco, 10,080 out of a voyage of 14,840; between New York and Canton it is about 500 miles shorter than Suez, and over 5,000 shorter than "around the Horn." As compared with the transcontinental railways it is only some 60 per cent. longer.

The following table will be convenient for reference in this connection. The distances have been measured by routes most convenient for sailing ships and slow freight steamers. The distances for swift mail and passenger steamers have not been calculated:

	Via Cape Horn.	Via Cape of Good Hope.	Via Nicaragua canal.	Distance saved.
	Miles.	*Miles.*	*Miles.*	*Miles.*
New York to—				
San Francisco	14,840	....	4,760	10,080
Behring Strait	16,100	....	7,882	8,218
Alaska	15,300	....	6,682	8,618
Acapulco	13,071	....	3,122	9,949
Mazatlan	13,631	....	3,682	9,949
Hong Kong	18,180	15,201	11,038	4,163
Yokohama	17,679	16,190	9,363	6,827
Melbourne	13,502	13,290	10,000	3,290
New Zealand	12,550	14,125	8,680	5,445
Sandwich Islands	14,230	....	6,388	7,842
Callao	10,689	....	3,713	6,976
Guayaquil	11,471	....	3,053	8,418
Valparaiso	9,750	....	4,700	5,050
New Orleans to—				
San Francisco	15,052	....	4,047	11,005
Acapulco	13,283	....	2,409	10,874
Mazatlan	13,843	....	2,969	10,874
Guayaquil	11,683	....	2,340	9,343
Callao	10,901	....	3,000	7,901
Valparaiso	9,962	....	3,987	5,975
Liverpool to—				
San Francisco	14,690	....	7,508	7,182
Acapulco	12,921	....	5,870	7,051
Mazatlan	13,481	....	6,430	7,051
Melbourne	13,352	13,140	12,748	392
New Zealand	12,400	13,975	11,349	2,626
Hong Kong	18,030	15,051	13,786	1,265
Yokohama	17,529	16,040	12,111	3,929
Guayaquil	11,321	....	5,890	5,431
Callao	10,539	....	6,461	4,078
Valparaiso	9,600	....	7,448	2,152
Sandwich Islands	14,080	....	9,136	4,944

From—	To eastern end of Nicaragua Canal.	From—	To western end of Nicaragua Canal.
	Miles.		*Miles.*
New York	2,021	San Francisco	2,578
Liverpool	4,769	Valparaiso	2,518
Hamburg	5,219	Callao	1,531
Amsterdam	4,994	Portland	3,219
Havre	4,874	Victoria	3,428
Cadiz	4,220		
New Orleans	1,308		

These are enormous advantages, insuring that the Nicaragua canal can easily collect 50 cents per ton or so more than the Suez, or say $2.50 per ton. At ½ cent per ton per mile this would only pay railway rates for 500 miles, thus in effect reducing the competitive rail distance to 2,500 miles, or as nearly, may be, half that via the canal *free of tolls*. What possible chance have the railways in a competition like this? A moderately fast line of steamers will make the voyage in less than two weeks, and all but express freights will be sure to go that way, and save time as well as money by doing so, while, more important than all, vast sources of traffic, like ores and timber, of which none is now shipped, will furnish a new and heavy traffic. The larger part of the timber supply of the Atlantic coast, for example, is likely to come from the Pacific coast via the canal.

We deem it therefore an entirely safe assumption that the traffic "in sight" is at most not over half what will exist after the canal has been three or four years in operation. But the traffic "in sight" has been growing rapidly of late years. Estimates, presumably impartial, by the Bureau of Statistics showed as the traffic "in sight:"

Year.	Ships.	Tons.
1879	2, 647	2, 671, 886
1885	4, 139	4, 252, 434

At the present time the most moderate estimates show 6,000,000 to 7,000,000 tons as the probable traffic by 1895. Lesseps claimed 10,000,000 as the minimum for the Panama Canal in late years, but that was certainly extravagant. That it will be attained within much less than ten years after the opening of the Nicaragua Canal, however, we regard as almost a certainty.

Now, even 6,000,000 tons at $2.50 per ton means a revenue of $15,000,000 per year. The operating expenses ought certainly to be much less than at Suez, where they are about $1,000,000, so that we may say that the revenue will pay 6 per cent. on some $250,000,000, and 3 per cent. on $500,000,000, with the probability of greatly increasing even these large figures. It is, therefore, apparent that it really matters little what the canal costs, as respects the expediency of constructing it, unless its cost is to exceed $200,000,000; and let any one with any knowledge of construction look over the profiles and quantities which we publish in this issue, and see where there is reasonable probability of even half that sum being required for construction. The actual cost has been usually estimated at some $60,000,000 to $65,000,000, and we confess we see no reason why those figures *may* not be realized. But we can also see reasons why they may possibly be doubled, and we therefore think the company is eminently wise in not putting before the public at this time any estimate of their own, but simply saying: "Here are the profiles and the quantities; judge of the cost for yourselves."

There will be an inevitable tendency to exaggerate the estimates thus challenged, from remembrance that the $40,000,000 Suez Canal actually cost $100,000,000, and the $120,000,000 Panama Canal cost over $200,000,000 actual and $350,000,000 nominal to prove that it could not be built at all. But as we showed at some length in our issue of July 14, 1888, the conditions at Nicaragua are vastly different from those Panama. We can not again go over in detail all the technical differences, but they are of the first importance. There is no unsolvable Chagres River problem; there is much less canal in excavation; there is much less deep cutting; there is no problem of water supply; there is no rotten, sliding rock; there are no endemic pestilences; three is a stiff trade breeze the year round to maintain health and comfort; there is a prior knowledge from detail surveys of just what is to be done which was wholly lacking at Panama; there is the advantage of all the experience gained at Panama, and of an official "base" on this side of the ocean instead of on the other side; and there is the practical certainty of far better management.

These are enormous advantages, and it therefore seems to us that no reasonable man can doubt, first, that the canal can be built for $100,000,000 to $150,000,000 at the very most, and secondly, that it will be exceedingly profitable even at that rate. If so it is quite immaterial what may be the precise cost of the canal, and the only error to be seriously feared is of *promising* to build the canal for less than really proves necessary, a result which always casts an injurious cloud on an enterprise. But it is not true that carefully made engineers' estimates are not generally safe guides. If any one glances at the top (general) profile on our inset sheet, and sees by the contrast of blue and orange colors how large a proportion of the length of the canal is natural navigation, and how large a proportion of what is left is mere dredging work, involving no uncertainties, he can hardly help deriving a most favorable augury for the success of the enterprise.

We have always felt a regret, and do now, that the Government did not take hold of this enterprise when President Grant negotiated a treaty to that effect and recommended it. Such a canal ought to be a great highway of nations, run not for private profit, but for the profit of a whole nation at least, if not of the whole world. But it was somewhat contrary to our national traditions, although not more than our river and harbor improvements were when they first began, and the opportunity has passed. It is worthy of consideration, however, whether even now a true regard for the public interest would not require that the same end should be attained measurably by a Government guaranty of interest on bonds for construction, in return for certain stipulations as to reduction of rates as traffic increases. If the whole conduct and cost of the enterprise be left to a private company, we do not doubt that they will be able to raise the money, but it will cost them 6 to 8 per cent. instead of the 3 per cent. which a Government guaranty would insure; and the company will reasonably claim that, having been left to push the enterprise through unaided, they had a right to enjoyment of the profits of their monopoly, however great, although in the beginning they might have been glad to accept the certainty of a moderate profit rather than the chance of a greater one.

Suez proves, however, that such companies prefer to reduce tolls considerably as traffic grows, merely to encourage its greater growth, and perhaps this alone will serve as sufficient check. Whatever be done we are satisfied from all the information we can gather that a few months more will see the main contracts let, the money for construction insured, and the work which is already begun in active progress; and we confidently look forward to seeing its construction prove one of the most honorable achievements of American enterprise, in broad contrast with the fiasco at Panama, which possibly for the moment may be somewhat of an impediment to the company's negotiations.

THE NICARAGUA SHIP CANAL.

[From Engineering News, September 11, 1889.]

(The maps and figures referred to are omitted.)

The work on this canal being now fairly begun, engineers in general will be greatly interested in the large colored sectional profile which accompanies this issue and which gives the first information as yet published of the precise nature of the material on the line, without which, of course, it is quite impossible to form very definite views as to the probable cost of the canal or the sufficiency of estimates.

We comment at some length on another page on the general status and promise of the enterprise as shown by this profile and other accompanying information, and in this article confine ourselves to a presentation of the facts which must form the basis of any opinion in regard to it, so far as they are as yet determined.

We published on July 14, 1888, a general summary of the results of the 1888 surveys, with maps and profiles. We reproduce in this issue three of these maps, with some corrections, viz, a general map of the entire route from ocean to ocean (Fig. 1) and detail maps of the western division (Fig. 2) and of the canal and basin part of the eastern division (Fig. (3). All the rest of the route consists merely of lake and slack-water river navigation.

Our large colored inset sheet shows, first, a general profile (A) of the entire route; and secondly, detail profiles to large scale of (B) the eastern division, Greytown to Deseado Basin; (C) middle division, Deseado Basin to San Juan River; (D) crest profile of the crest and embankments which together form the San Francisco and Machado Basins; (E) center line of San Juan River, showing the character of bottom and extent of dredging required; (F) western division, Lake Nicaragua to Brito.

On all these detail profiles the material is accurately indicated in a manner which, once comprehended by a brief study of the symbols, becomes very distinctive. Thus, *red indicates clay* wherever it appears. Red clay is shown by plain red; blue clay, by red striped with blue; yellow clay, by red striped with yellow; white clay, by red striped with white. *Yellow indicates sand*, gravel being indicated by black dots on a yellow base, and clay and sand mixed by red and yellow stripes crossing diagonally. *Loams* are indicated by black vertical stripes. If it be a clayey loam, these stripes are on a red base; if a sandy loam, on a yellow base.

The distinction between rock and earthy materials of all kinds is so distinctive as to be at once grasped by the eye, even without the aid of any special description. Thus it is hardly necessary to refer to the key at all, although 12 different kinds of material are indicated.

In reference to the character of the earths, we may say, from personal examination of the samples of borings, and from the universal testimony, that all the clays seem to be exceedingly retentive of water. Even the mixed clay and sand seem to be an excellent natural puddle. The "loams" are all of them poor material to have about a canal bottom or dam foundation, and where they exist must be got out of the way. Fortunately, this material is not often encountered in objectionable positions, although some considerable deposits of it will be found under the embankment dams shown in Profile D.

The profile is reduced photographically from the very elaborate profiles which have been constructed by the company to the usual railway profile scales of 400 feet per inch horizontal and 30 feet per inch vertical. The reduced profile is to a scale of 3,000 feet per inch horizontal or only one seventy-fifth as large, and proportionately for the vertical scale, but as the reduction was wholly photographic the profile still remains minutely accurate, and may be enlarged to 7½ times its present size by a magnifying glass, or otherwise, and still afford as great accuracy as the original profiles. We think it but due to Mr. Menocal and his able staff of assistants to say that in a somewhat large experience with plans of this nature, we have never seen any which showed such signs of careful preparation; nor do we recall any large enterprise in which there has been any approach to equal pains to determine precisely what had to be done before attempting to do it.

The basis of fact on which the sectional part of the profile is constructed the reader has before him in the profiles themselves, where the position and depth of the borings taken is accurately indicated to scale by vertical black lines. A considerable number of additional borings were taken too far off the line to be shown on it, but with this exception all the borings taken appear, except along the bed of the San Juan River (Profile E), where they were not accurately located, nor were they as carefully made as the others, being confined for the most part to a superficial examination of the bottom by rods, all material which could not be thus penetrated being called rock. It is not claimed, therefore, that this profile is as precise as the others, but it is believed to err chiefly by too much rock.

The other borings on all the profiles were taken with boring tools adapted for penetrating earthy materials only, the assumption being everywhere that the material below the lowest point to which the boring could be pushed was rock. This tends to safety in the estimates by exaggerating, if anything, the amount of rock; and it is altogether probable that, at a few points on the profile at least, the amount of rock is less than is shown. On the other hand, in the foundations of the locks it would be a disadvantage if the material should not prove to be rock; but the only doubt in this respect is deemed to be in regard to Lock No. 1, Locks No. 2, 3, 4, 5, and 6 being quite certainly on rock, and the material under Lock No. 1 being at least hard material in which boring tools will not penetrate.

Further borings by rock drills through the entire depth, rock and all, are now in progress at the great eastern divide cut, and will afford details for the subdivision of the "rock" into at least two classes, rock proper and *talpetate* or *tepetate*, two materials which differ very much in hardness and cost of excavation. The rock proper is a very hard, unstratified volcanic rock, and of this the great rock cut in the eastern division is mainly composed, with a coating between it and the clay of *talpetate*. The last is a material we have often described, found only in volcanic countries, and supposed to consist of consolidated volcanic ash or mud. It holds a slope quite as well as rock, and also requires powder for its economical working, being sometimes hard enough to serve as building material, but being much more cheaply excavated than ordinary rock, resembling in texture and hardness a very much under-baked brick more than any other material with which we are familiar. Immense deposits of it exist throughout Mexico and Central and South America. It will evidently tend to reduce the cost of the work quite sensibly should there prove to be a considerable percentage of this *talpetate* in the material shown as "rock" on the profile, but for the present this contingency is neglected.

The extraordinary natural advantages of this route, as shown by the large proportion of it on which there is a natural slack-water navigation, will be seen by a glance at the upper (general) profile on our colored sheet, on which all this class of navigation is colored blue, and all that part requiring canal excavation colored orange. In the aggregate there is:

	Miles.	
Canal in excavation:		
East side	16.048	
West side	11.160	
Six locks	0.759	
		27.967 miles.
Basin of the Deseado	4.220	
Basin of the San Francisco	11.368	
Basin of Tola	5.504	
		21.092 miles.
River San Juan	64.540	
Lake Nicaragua	56.500	
		121.040 miles.
Total length of route		170.099 miles.

Contrasting this with the two great previous canal enterprises we have:

Route.	Length.	Canal excavation.
	Miles.	*Miles.*
Suez	99.2	65
Panama	46.5	46.5
Nicaragua	170.1	27.9

Thus, although the Nicaragua route is the longest of the three, owing to a long, unbroken stretch of 121 miles of free navigation in the midst of it, the length of *canal proper* is by far the shortest of the three. By percentages we have the following comparison:

	Miles.	Per cent.
Nicaragua Canal:		
Canal in excavation	27.967	16.4
Free navigation, basins	21.092	12.4 } 83.6
Free navigation, lake and river	121.040	71.2
Total	170.099	100.0
Suez Canal:		
Canal in excavation	87.2	87.9
Free navigation, lake	12.0	12.1
Total	99.2	100.0

The Panama Canal is wholly in excavation, 4.3 miles of it being below sea level, and 42.2 miles above sea level, and mostly very much above it, as will be seen by referring to our profile of that canal published June 2, 1889. Up to that date the company's estimate showed 49,000,000 cubic meters (65,000,000 cubic yards) while there was about as much more work required even to make the lock canal. How many times more than this would have been needed to make a sea-level canal we can only guess. As this project is now hopelessly dead, however, we need not trouble ourselves further with data regarding it. The total estimate of rock and earth excavation for the Nicaragua Canal is only 55,513,638 cubic yards, as shown in more detail below.

A previous more detailed summary, differing somewhat decimally with that just given, but so slightly that it does not seem worth while to take the trouble to correct the trifling differences, shows the canal to consist of the following elements:

		West side.	East side.	Total.
		Miles.	*Miles.*	*Miles.*
A.	Sea-level canal dredged in earth from the coast	.57	10.00	10.57
B.	Rock through cuts with or without a coating of earth on top	6.40	2.836	9.236
C.	Canal in earth, through cuts, no rock	2.42	2.146	4.566
D.	Canal chiefly in earth, but with a layer of rock in the bottom	2.00	.354	2.354
	Total canal, apart from locks	11.39	15.336	26.726
E.	Natural surface flooded by proposed water levels so as to give 30 feet of water or over, without any dredging or excavation	4.53	13.60	18.13
F.	Do., requiring earth dredging only	.74	2.70	3.44
G.	Do., requiring rock excavation	0	0	0
H.	Locks	*.369	†.246 ‡.123	.738
I.	Natural water courses having 30 feet or over on proposed level	37.04	43.67	80.71
K.	Do., requiring earth dredging only	2.40	24.10	26.50
L.	Do., requiring any rock excavation	3.5	10.33	13.83

*All rock. †Rock. ‡Earth.

SUMMARY.

		Miles.
Natural water courses or artificial basins requiring no work at all on them to give 30 feet of water		98 84
Basin, river, and lake navigation requiring earth dredging below proposed water surface only to give 30 feet of water		29.94
Do., having a layer of rock in the bottom to be excavated or dredged		13.83
	Miles.	
Canal sections, dredged in at sea level	10.57	
Earth through cuts, no rock	4.566	
Rock through cuts, some earth	9.236	
Earth through cuts, some rock	2.354	
Total length of canal in through cut		26.762
Six locks		0.738
		170.074

The company, somewhat to our regret, but we can not say unwisely, prefer not to put forward at this time any estimate of total cost whatever. The quantities, as computed by their engineers, they are quite willing to give, and they are given below. The transverse and longitudinal sections on which the quantities are based are shown herewith, and if they do not suit any one's ideas of what such sections should be, it is easy to recompute the quantities from the data given in this issue, either precisely or approximately. As to the cost of the work per yard, there has been so much discredit, just and unjust, thrown on such estimates in the past, that the company as yet prefer to maintain an entirely noncommittal attitude, and they decline to furnish us with any estimate on their part of what the work will cost per yard or in the aggregate, at least until the work has been actually let. They say simply: "Here are our quantities; here are the profiles and cross sections on which the quantities are based; the climatic and other conditions, so far as known, are thus and so. Make your own estimates for the present of what the total cost will be." This privilege we exercise elsewhere to some extent, but in the meantime will merely note that Chief Engineer Menocal's prices for the more important items in his estimate of 1885, which he states he has seen no reason to regard as too low, are as follows:

Earth excavation	per cubic yard	$0.40
Earth dredging	do	.20
Rock excavation	do	1.50
Rock under water	do	5.00
Stone pitching, rock furnished	do	2.00
Concrete	do	6.00
Stone in breakwater (from divide cuts)	do	1.50
Sheet piling in place	per M. B. M.	70.00
Trestle for dumping rock	per lin. ft.	22.00
Clearing and grubbing	per acre	100.00

This includes the main items of cost. The total quantities for the larger items are:

		Cubic yards.
Earth dredging for canal (all below sea level)		23,489,478
Earth excavation (all earth above sea level)		16,440,368
Rock excavation		15,008,347
Rock under water		575,445
Total apart from harbor work		55,513,638
	Cubic yards.	
Greytown harbor, dredging	9,055,460	
Brito harbor, dredging	5,658,898	
		14,714,358
Total earth and rock excavation		70,227,996
Rock fills for dams and breakwaters (from divide cuts)		4,845,787
Earth fills for dams and breakwaters (borrowed from canal excavation)		5,085,171
Concrete (chiefly for locks)		518,675
Stone pitching		94,813

Among the miscellaneous items provided for in the estimates whose adequacy can be most satisfactorily judged by their aggregate cost are the following:

Gates for the six locks	$783,242
Two movable dams or guard gates	600,000
Machinery for locks	550,000
Buildings for locks	165,000
Pumping (chiefly for Locks 1 and 6)	200,000
Plant for lighting and buoying canal	372,200
Crib piers at entrances to canal (apart from breakwaters included in rock fills)	783,924
Three swing bridges across canal	60,000
128 miles telegraph	64,000
Total of miscellaneous items	3,578,366

By adding the total of the above list to the product of the above list of prices any one can determine for himself what may be called the "visible cost," and he will find it in the neighborhood of $55,000,000. To this there must beyond all question be added a very considerable percentage for hospitals, shops, cost of labor supply, delays by possible epidemics. Even in this country we should add as a matter of course 10 per cent. to the above estimate for "engineering and contingencies." For this work there ought to be beyond all question a considerably larger percentage added, and there may be some question likewise as to whether there may not be slips and landslides, etc., which will require an enlargement of the proposed cross-sections. As to that, however, we may say that there seems little chance of it in the two big rock cuts where alone it could become an important consideration.

We ought to know absolutely as to this in a short time, when the borings through the rock are completed, as above noted, but in the meantime all the indications are that the rock will hold a steep slope well. This we understand to be the general opinion of all engineers and contractors who have examined the cut. Whatever other difficulties may arise, there seems no reasonable chance of there being another case of a mountain sliding in as fast as excavated, the formation being quite different from that at Panama.

The general character of the alignment of the whole route is correctly indicated in Figs. 2 and 3. About two-thirds of the route is tangent (omitting the lake, which is all tangent) and the remainder easy curves of 4,000 to 6,000 feet radius for the most part. The sharpest curve is in the divide cut, 2° 16′, or 2,528 feet radius. There are two or three other curves of about the same radius in the river, but for the most part the river channel is wide and straight. The precise alignment of the sailing line is not yet regarded as absolutely fixed; therefore, we do not give a complete table of alignment. A new alignment has recently been shown to be possible for the great divide cut, shown by the dotted line *A* in Fig. 3, which not only saves distance and curvature but saves about 1,000,000 cubic yards of rock excavation included in the above quantities.

After the completion of the chief engineer's report and estimate, an advisory board to report on the practicability and cost of the canal, as proposed by the chief engineer, was appointed as noted in our issue of Jan. 26, the board consisting of John Bogart, E. D. T. Myers, C. T. Harvey, H. A. Hitchcock, and A. M. Wellington. This board reported some time ago, but the company is not yet ready to give out the text of their report for publication for the reason above noted, that they do not desire as yet to commit themselves even by implication to any estimate of cost whatever, confining themselves simply to presentation of quantities, and other controlling conditions.

As for the two important and in a measure controlling conditions of climate and labor supply, we understand that the latter is not likely to be a very serious difficulty. Owing to the nature of the work, as above and below outlined, the number of employés required will not be at all in proportion to the magnitude of the work, since a very large part of it will be executed by machinery. All the earth excavation may be classed as dredging, since it will all be executed by dredging machinery, and this accounts for nearly 55,000,000 out of the 70,000,000 cubic yards of excavation. For this very few men will be required. The 500,000 yards of concrete will also be mixed by machinery and require labor in any amount for ramming only. The 15,600,000 cubic yards of rock is, most of it (14,000,000 cubic yards), in the two great divide cuts, and will be drilled and hauled by machinery, requiring labor in large amount for loading only. Here, however, will be the greatest demand for labor, and possibly 10,000 men may be required on these two cuts alone. The dams and embankments are now to be all rock fills, and not built of concrete, as heretofore proposed, the suggestions of this journal in favor of so constructing the dams, made in its issue of July 28, 1888, having been adopted by the company, thus greatly simplifying that important part of the work. All the skilled labor which will now be required for the dams will be only for a little sheet piling and trestle work.

It appears to be generally admitted that Jamaica negroes will furnish the bulk of the labor, and that 10,000 to 15,000 can be readily obtained from that island alone at $1 per day, more or less. With the miscellaneous thousands who are quite sure to flock to the work from all the other surrounding countries and islands, this ought to make the question of labor supply a comparatively simple one; provided no long-continued epidemics occur to drive away labor.

In respect to the question of health and climate, all accounts concur that the entire route is now and always has been free from dangerous epidemic diseases, and from frequent epidemics as well. Like New York and New Orleans, Greytown has had epidemics of cholera and yellow fever, but the last was some twenty years or more ago. In regard to the western coast, on which over a third of the work is situated, there does not seem to be the slightest ground for any anxiety as to health conditions. The climate is warm throughout the year, and hence somewhat debilitating for whites, but the rainfall is moderate, and there is rather less cause for anxiety than there would be for summer work in Texas, a great ameliorating influence being the brisk trade winds, which blow uniformly from the east over the entire length of the canal, and make the nights cool and comfortable. The importance of this advantage over Panama, where this trade wind is wholly absent, can hardly be exaggerated.

On the eastern division there is a great deal of rain; about as much as at Panama, or a decided wetness throughout most of the year. There is also not a little *calentura* (the Spanish *name for* intermittent fever) which in tropical regions is at times a serious and fatal disease. But with proper care and caution, and avoidance of all use of stimulants except a small dose at night after work, there does not seem to be any difficulty in keeping in good health continuously in eastern Nicaragua. According to a great variety of independent information which has come to us from time to time, the great and only essential for health along the coast is strict attention to hygiene. Yellow fever has never existed continuously in Greytown, as it does in Havana and Vera Cruz. It may possibly become endemic during construction unless careful sanitary precautions are taken, because the town will be likely to have a mushroom growth to a considerable size; but the company, with eminent foresight and wisdom, are now laying pipes to supply abundant pure water, and purpose sewering the town also, we are informed, as soon as its growth begins.

A most important consideration in respect to this question, moreover, is this: The general character of the coast is a broad, low coast flat, through which the dredging occurs, ending in an abrupt escarpment, in the lowest point of which the "great divide cut" occurs, the main crest in the vicinity being upwards of 500 feet high, and directly exposed to the trade winds. It is at this cut that the bulk of the laboring force is required. As the work will last four or five years at least, the camp may be permanent, and the conditions of insuring health in a great permanent camp exposed to the direct blast of the trade wind and with an abundant supply of pure, cold water, would seem to be unusually favorable. That they are so, and that health might be maintained in such a camp by strict policing, even if epidemics were raging in Greytown, seems to be the general opinion of those who ought to know. There is no use disguising the fact, however, that there will be danger of sickness at Greytown when the inevitable host of camp followers occupies it, unless, as ought to be done, the whole town can be put and kept under martial law.

It is proposed to construct 35 miles of railway on the eastern division, from Greytown to the Ochoa dam, and 18 miles on the western division, from the Pacific to the Lake. It is now under consideration, however, whether the 10 miles of railway between Greytown and Lock No. 1 can not be saved, starting the railway from the latter point, and using east of it the natural chain of water communication shown on Fig. 3, improved a little at points, until a channel can be excavated through to the same point by the first cut of the dredges. In that case, the breakwaters at Greytown would be built by deposit of stone from scows instead of from railway cars. We can not see why the suggestion is not a good one.

The dimensions proposed for the locks are 650 feet long by 70 feet wide (increased this year from 65 feet) by 28 feet deep. The chamber width of the locks will be 80 feet. The Sault Ste. Marie lock, the largest yet built in the world, is 515 feet by 80 feet by 17 feet on miter sills, or 16 feet draught. The new lock now building will be 800 feet by 100 feet by 21 feet, on miter sills, but this great size is only for the purpose of letting through several vessels at once. The main dimensions of the largest ocean steamers are as follows:

	Etruria and Umbria.	City of New York and City of Paris.	Teutonic and Majestic.
Length	501.6	565	582
Breadth	57.2	63.2	57.5
Depth hold	38.2	42	39.2
Draught (about)	27	27+	27+

The above draughts is about all these vessels can draw to enter New York; the "Plimpsol mark" is somewhat higher.

The above seems all the data which it is necessary to give, in addition to that given in our issue of July 14, 1888, and in the following article. This is certainly the most important engineering project now before the world, and we can not doubt will be triumphantly carried through to completion. Had the project in its present shape been before the Lesseps congress of 1879, it can not reasonably be doubted that even that most prejudiced body would have adopted it *nem. con.*, as it is from every point of view so vastly superior to that at Panama, and the Nicaragua Canal would now be open to the world; but, unfortunately, there was only the old survey of 1872-'73, with its 20 locks, 4 dams of the San Juan, 6½ miles of extra distance, and 49 instead of 27 miles of canal excavation to lay before that body.

Preliminary work has been now for some weeks in progress on the canal, mainly in the way of getting the camps established; water pipes to supply Greytown laid; railway located and right of way cleared; deep drillings made through the rock cut; harbor works at Greytown started, etc. No contracts have as yet been let, but negotiations are in progress with several parties. When the contracts are let they will probably be very large ones, to three or four parties only. We understand that the question of raising the money is now regarded as merely one of detail, not of difficulty.

APPENDIX F.

THE NICARAGUA CANAL.

[From the *California Banker's Magazine*, October, 1890.]

The active and successful prosecution of work on the interoceanic waterway through Nicaragua is a matter of such vital importance to the Pacific coast that it should receive the cordial support of all our people. Like all great works of this character, however, the far-reaching results are little considered by those whose interests will be the most affected.

When the subject was first introduced to the people of this coast in 1880 the growing interest of agriculturists was met by the assertion that the railways would furnish all the necessary transportation for wheat to Atlantic ports, whence it could be cheaply carried to Europe by sea. The promise was not fulfilled, and the Cape Horn route still controls the Pacific coast wheat trade, which is as much a gamble as any hazardous game of chance can be. Ships are now generally chartered and loaded by one party; the cargo is purchased, loaded, insured, and sails on its voyage of four to four and a half months of *free storage*, during which time it must be disposed of, frequently at a loss, unless, as a last resort, consigned to an European firm, in which case commissions and the usual multiplicity of charges generally make a heavy loss to the shipper. The market here, under normal conditions, follows the English market so closely that it is seldom that a cargo just loaded shows any profit with charges added; often on the day of sailing it shows a loss, and becomes a gamble, with chances against the shipper. It is a noticeable fact that fortunes have been lost here in the export wheat trade, while none have been made. It is not in the prescience of humanity to foresee the future; to correctly forecast the rainfall and weather months in advance, and to correctly gauge crops at the four quarters of the globe not yet planted; it becomes a gamble against the forces of nature. Such has been the Pacific coast export wheat trade; such it will cease to be the day the canal is open!

The time for transportation will be reduced to *twenty-five days' easy steaming*, and the distance *decreased by* 10,000 *miles*. Wheat will be shipped as other merchandise, in any quantity, from 5 tons to 5,000, already sold by wire, or consigned with a margin already ascertained, with a delivery practically assured within a day or two. It will become a mercantile transaction on comparatively assured profit, however small, the gambling element almost entirely eliminated. The producer of small or large quantity can ship his own product, if he wishes, as ocean steamers will be always ready to receive it, or any other freight, in any quantity. *Ocean transportation is the cheapest known to commerce*, comparing with average railway transportation as *one to five* in cost, and the ocean is free to all; admitting of no pools or combinations. It is God's great highway—nature's anti-monopoly route, a road that never wears out!

"Not so thou;
Unchangeable save to thy wild waves play
Time writes no wrinkle on thine azure brow:
Such, as creation's dawn beheld, thou rollest now!"

One large ship can carry a cargo equal to twenty railway trains of ten cars each. The completion of the canal will open the markets of northern Europe to California fruits and garden products, by the use of steamship refrigerators. A temperature of 38° to 40° Fahr. will prevent decay in fruit indefinitely, if the cold atmosphere be devoid of moisture. Fresh meats have been, for a few years, successfully transported in this manner from Australia and New Zealand to Europe. The transportations of meats in refrigerators on sea voyages requires a temperature about 26° Fahr., which is a much more severe test than will be required in transporting fruit. The past season has opened the Eastern market to our horticulturists, and they can fully appreciate the still greater advantages of *a market in northern Europe* for their grapes, pears, peaches, plums, oranges; all the varied products of the orchard and the farm; arriving there during a portion of the year at a time when local products of this character are not to be purchased at any price. With such a demand added to our domestic market, overproduction will be impossible.

The *export lumber trade* of the northwest coast will be vastly increased by the waterway through Nicaragua. Already occasional cargoes are sent via Cape Horn to Europe, and via cars to the eastern seaboard. But when lumber can be freighted at materially decreased cost, and in one-fifth the time, the trade will rapidly grow in importance. Europe and our Eastern seaboard is mostly denuded of timber, and the demand will steadily augment at improving prices. The States of Washington and Oregon, as well as the Territory of Alaska, will in this trade promptly realize the benefit of the new commercial route.

The *trade of India, China, and Japan can not* fail to be greatly affected. The Suez route will no longer be able to supply our Atlantic ports with tea, silks, etc., the route across the Pacific and via Nicaragua being three days' shorter steaming distance, under much more favorable conditions as regards navigation, with Honolulu as a port of call and coaling station. The mistaken policy of making our Pacific coast ports *way stations* and New York the main distributing point must then be discarded, and distribution *from the Pacific coast eastward* will be the aim of railway companies with terminals at Pacific ports. The diversion of this trade need not be feared at San Francisco, and the conditions connected therewith, now imposed upon us by the present railway policy, can not well be made worse, as under them we have been gradually losing the trade of China and Japan, which properly belongs to us by geographical position.

The territory in northwestern America tributary to the canal will extend to the Arctic Ocean and eastward to the 100° meridian. For five months in the year water communication eastward from the interior of the great northwest is cut off by frozen lakes, rivers, and canals. During this period, instead of yearly awaiting the opening of navigation, transportation to the Pacific coast will solve the question of time and interest, with the assistance of the open waterway through Nicaragua to Atlantic ports. This alone will more than compensate our Western railway systems for any diversion of trade caused by the canal, and, with the adoption of the policy of distribution eastward from Pacific coast posts, will materially improve their earning capacity, independent of the rapid development of the Pacific coast after the opening of the new waterway.

The fisheries of the Pacific coast, now in their infancy, will add to the revenues of the canal, and greatly increase our shipping interests. Already the attention of parties engaged in this industry on the Atlantic coast has been attracted to this new field, and when they can place their vessels on the fishing ground in a comparatively short voyage, and return cargoes unbroken in bulk, there will be inducement for a large and remunerative business. We have considered thus far only the *commercial* advantages of the Nicaragua Canal; much more might be written on this branch of the subject, but the limits of this paper forbidding, we must pass on to the consideration of *political conditions*.

The construction of the Nicaragua Canal under present auspices will secure the *domination of the United States over the American Continent*, politically as well as commercially. The position of Lake Nicaragua is unique; Gibraltar is not a circumstance to it in importance. A naval station on this inland sea, with fortified termini and an efficient fleet, will control the *Atlantic eastward to the Windward Islands of the West Indies* and westward to the *Hawaiian Islands and Samoa*. On its fresh waters iron-clads can lay without diminished speed caused by foul bottoms, with fresh water for boilers, in a delightful climate, splendid harbors, surrounded by a territory producing maintenance for the personnel of fleets and armies. *The nation that, with the Nicaraguan Government on a joint agreement, controls Lake Nicaragua will then control the destiny of the Western Hemisphere;* it will be, in fact, *a constant assertion of the Monroe doctrine*, securing respect for its requirements by the peaceable possession of power to assert them. The foreign policy of our country will become of greater importance every year. A nation of 65,000,000 can not ignore, at this age, its national responsibilities and maintain its self-respect. The protection of its citizens and their property abroad is as much a duty as government at home. In vain may we send out commissions to seek outlets for our products and manufactures if we do not propose to follow them with our national protection. The public demand for a modern navy indicates the will of our countrymen on this momentous question.

One great advantage possessed by the Nicaraguan Canal over any other project of the kind is the *fertility and resources of the territory through which it passes*. The Suez Canal has a sandy desert on each side; the Panama Isthmus is a region of floods without local resources, but Nicaragua is one of the *garden spots of the world*. With a climate tempered by the northeast trades, which, in this favored region, blow perennially across the Republic, with a fertile soil, assured rainfall, and internal water communication, we shall there see a development of resources shortly after the canal is opened which will alone pay the cost of its maintenance, and aid in its increasing dividends. Coffee, sugar, cochineal, indigo, the finest cocoa in the world, India rubber, cotton, and all the tropical fruits are among its productions, while a large part of the Republic is covered with valuable forests of mahogany, cedar, grenadilla, black walnut, ebony, and various dyewoods. In the eastern department, bordering the lakes, are found rich mines of gold and silver, some of which have been worked for years, mostly by European capital. When Lake Managua has been connected with Lake Nicaragua by the short canal provided for, and all this fertile region is connected by water communication, supplemented by railroads, it needs no prophet to predict the development which will ensue on this highway of the world's commerce. It would demand a canal on its local conditions, aside from its character as an interoceanic highway.

What can be expected from the canal financially? This fundamental question is worthy of critical investigation.

The character of the work, with its twenty-eight miles of canal in excavation on the surface, with its easily-solved engineering problems, the most difficult of which (the restoration of the harbor at San Juan del Norte) is already partially solved, permit us to predict that its limit of cost can be assured with reasonable certainty. The several surveys have been exhaustive and satisfactory, and the borings have furnished the necessary information as to material to be excavated. With this abundant data, the engineer's estimate is $64,043,697, exclusive of interest during construction and banker's commissions. The careful report of the canal committee of the board of trade of San Francisco (of which the writer had the honor to be chairman) in 1880, places the estimate of possible cost at $100,000,000, and we now see no reason for increasing this except for the substitution of larger locks, which it is now proposed to increase to the following dimensions: 1,000 feet long, 100 feet wide, and 30 feet deep, which will enable two to four vessels to pass through at one lockage. The estimated tonnage by the report of 1880, alluded to, was 5,000,000 tons per annum. Subsequent developments assure us of 6,000,000 tons before the canal can be completed in 1897. At $2.50 per ton toll (about the same as now charged at Suez), this will make an annual revenue of $15,000,000, from which, deducting the liberal estimate of $1,000,000 per annum for operating expenses and repairs, leaves a net revenue of 14 per cent. per annum. Even if the cost be increased to $150,000,000, we have a net revenue per annum of 9¼ per cent. The Suez Canal, costing $94,000,000, has returned larger dividends than these, and is still increasing. These estimates do not include the *local traffic*, which would rapidly develop into larger proportions, or the *passenger traffic*, which would be large, for a trip through the Nicaragua Canal will become a favorite recreation, owing to the beauty of the scenery and the climate of the lake region. There is not a doubt that the property would start out on a paying basis, and rapidly develop into one of the best-paying investments in the world; ultimately better than the Suez Canal, which served to divert a commerce *already* developed, while the American Canal has all the possibilities of an equal traffic, with illimitable development in the future.

The lockage question is one of interest to students of this subject, and I may be permitted in this connection to quote from the recent report of Charles T. Harvey, C. E., regarding the operation of the lock canal at Sault San Marie, between Lake Superior and Ontario. This work shows the following comparison with the Suez Canal (water level) in the year 1889:

	Number.	Tons freight.
Lake Superior canal lockages	4, 684	7, 516, 022
Suez Canal passages	3, 425	6, 800, 854
Total	1, 259	709, 168

The American lake canal with lock has thus exceeded the Suez Canal, in 1889, 33 *per cent in voyages and* 10 *per cent in freight*, and, therefore, ranks first as to commerce among the world's artificial water ways. And this was done in *seven months'* day and night work, against the twelve months at Suez, the American work having been blocked by ice during five months of the year, approximately.

Why this enormous development of tonnage, except that it is unapproachably cheaper than land carriage can ever be? Eleven minutes fills the lock and eight minutes discharges it; 87 vessels have been passed through daily. On this showing the capacity of the Nicaragua Canal with one set of locks may be placed at 14,000,000 tons per annum, which can be doubled by duplicating locks, as the water used for lockage with one set of locks is only 10 per cent of that now being discharged by the Rio San Juan at ordinary lake level, without regard to rainfall and without lowering the lake level. The expense of operating locks is well attested by the Lake Superior Canal, where nearly 8,000,000 tons were lock-lifted in 1889 at an expense of $36,000, making a rate of *four-tenths of a mill per ton*. The liability to accident is illustrated by the experience of a third of a century at the same water way. The lock gates are operated by hydraulic power and guard gates are placed at a proper distance, to be used when necessary. Occasionally minor accidents have occurred at the entrance of the lock, but nothing that materially interfered with traffic. Alluding to the work of the Lake Superior Canal Mr. Harvey writes: "I have seen fifteen steamers, some of 3,000 tons, as *passed, passing, or waiting to pass the locks*, and within one hour all had disappeared on their respective voyages." I may conclude these observations on locks by quoting from the report of the board of trade of San Francisco, published in 1880, before alluded to: "We see no reason why the philosophy that nature teaches should not be made use of to conquer the obstacles that nature places before us; and we claim that it is better and more reasonable to carry a ship over a summit by means of lift locks than to build a sea level canal at an incalculably increased cost."

The Nicaragua Canal, supplemented by increased facilities for distribution by rail, is the great need of San Francisco and other Pacific coast ports. It will certainly change the highways of commercial transportation; but, where a temporary injury is inflicted, a three-fold compensation comes with the adjustment of the new conditions. Our coast, our country, and the world are ready for this great and beneficent enterprise. It will be a prosperous day for San Francisco when its wharves are crowded with ocean steamers which have passed "the Gate of the Pacific," and through the Golden Gate to our commercial metropolis. The ocean—*God's great highway*—will be open to us, with a reduction in distance of 10,000 miles to European and Atlantic seaports—two-thirds of the navigable distance discarded forever—nearly one-half of the earth's circumference. The American flag restored to the ocean; American seamen ready to defend their country abroad; increased markets for our producers; increased business for our merchants; increased values for our land owners; all these, with increased prestige and political influence to the great Republic will follow the opening of this ocean highway. Before the dawn of the twentieth century this will have been accomplished, marking another epoch in the commercial history of the world; a monument to American energy and a benison to mankind.

WILLIAM L. MERRY.

APPENDIX G.

NICARAGUA CANAL CONSTRUCTION COMPANY.

REPORT ON FINAL LOCATION OF THE CANAL.

[By A. G. MENOCAL, *Chief Engineer*]

NEW YORK, *January* 31, 1889.

To the President and Board of Directors of the Nicaragua Canal Construction Company:

GENTLEMEN: I have the honor to submit the following report of the results of the final surveys for the location of the canal through the territory of the Republic of Nicaragua and in that of Costa Rica, by the Nicaragua Canal Construction Company under contract with, and on account of, the Nicaragua Canal Association.

These surveys were commenced in the early part of the month of December, 1887, and were conducted with marked ability and uniform devotion to duty by eight well equipped parties, supplemented by a well-organized and efficient medical department and the necessary force of draughtsmen, artists, clerks, stenographers, and other subordinate assistants.

The eight parties comprising the regular field working force were divided as follows:

Six land surveying parties, each composed of one engineer in charge, four assistants, and from fifteen to twenty laborers.

One hydrographic party with one engineer in charge, three assistants and ten men.

One boring party in charge of an engineer, with ten laborers.

In addition to this permanent force, two or three smaller parties, each composed of one or two engineers and a sufficient number of assistants and laborers, were constantly employed in carrying out local surveys and reconnaissances, either in advance of the locating force or supplementing the location by local detailed surveys at places where additional information was regarded as necessary for a more perfect knowledge of the complicated topography.

This large and efficient force was kept constantly employed from the 15th of December until the latter part of June, when the advanced state of the work made necessary a reduction in the number of employés. In fact, at this time the canal had been located from the Atlantic to the Pacific, and but little information, and this not essential to the solution of the problem, but desirable only in order to arrive at the degree of accuracy prescribed by the company, remained to be obtained. Some of the engineers were then ordered to the company's office in New York, to be engaged in plotting and developing, in a comprehensive and concise form, the results of the field operations. The field working force was reduced to three surveying parties and the boring party, which force has been actively at work and is still engaged in making local surveys, cross-sectioning in the vicinity of the canal work, locating the flowage line in the San Francisco Basin and in the valley of the river San Carlos, and surveying for a canal between Lakes Managua and Nicaragua.

The work accomplished to the present time may be summed up as follows:

First. Location of the canal from the Pacific to Lake Nicaragua, with numerous cross-sections and the survey of the flowage line in the proposed basin in the valleys of the rivers Grande and Tola. Through these valleys two locations have been made, one for a canal in excavation throughout and the other for a canal partly through a deep basin. Both have been located with the same care and attention to detail. The estimate submitted with this report is based on the latter plan.

The proposed flooded area contains over 4,000 acres of grazing land, and the relative cost of the two methods of canalization can only be ascertained after this land has been legally condemned. Borings have been made at numerous points along the route, including the basin, the curves having been actually located on the ground and detailed surveys for artificial drains, embankments, and weirs, and of the sites of the locks, etc., having been elaborated for both plans, there need be no delay in the progress of the work when a final decision is reached.

Second. The hydrographic party has completed the survey of the harbor of Brito, of the west coast of Lake Nicaragua, in the vicinity of the mouth of the river Lajas, of the east coast of the lake at Fort San Carlos, several local surveys in the river San Juan, and the survey of Greytown and adjacent coast and lagoons. These surveys have been carried out with remarkable skill and accuracy and very much in detail. In the lake the soundings have been carried out beyond the 40-foot contour, and offshore at Brito and Greytown to the 9-fathom line. In the inner harbors and in the rivers in the vicinity thereof the exact contour of the bottom can be determined by the numerous soundings taken. Observations for determining the currents, both inside and outside the harbors, for the direction of the winds, and for the rise and fall of the tide, have also been taken. All this comprises a mass of most valuable data, which has been used to great advantage in designing the necessary work for the improvement of the harbors and in estimating the amount and cost of the dredging required therein.

Third. Local surveys have been made in the river San Juan at all places where the data on hand were deemed insufficient for a close estimate of the amount and cost of excavation needed, or to determine with reasonable precision the difficulties likely to be encountered in the construction of dams, embankments, or other works entering as important factors in the general scheme.

Fourth. The river San Carlos has been surveyed from its confluence with the San Juan to a point about 3 miles above its tributary "Tres Amigos," where the contour 106 feet above sea level was reached. From that point this 106 feet contour has been instrumentally located, east of the main river, and up both banks of all its tributaries coming from that side, following all the sinuosities in the expansions and contractions of the valley until Ochoa was reached, at the south abutment of the proposed dam across the river San Juan, thus establishing, beyond a doubt, the practicability, at a comparatively small cost, of impounding the waters of the San Carlos at the elevation of 106 feet above sea level, as raised by the proposed dam at Ochoa.

Fifth. The survey of that region from the valley of the Machado above the site of the dam at Ochoa to Greytown has been the subject of much labor and serious consideration, and has consumed much time, and not less than four-fifths of the labor of the expedition. The primeval condition of the country, covered as it is with dense vegetation and high forest growth, through which no extended view can be obtained from any point, of itself renders an accurate knowledge of its topographical features both laborious and difficult to obtain; but if I add to this the absolute want of means of communication except by canoe through capricious water courses, of which but little information has been acquired by previous explorations, and an unusually complicated topography, in which extensive swamps and more or less connected ranges of hills are constantly met with in such an irregular and unexpected manner as to baffle completely all calculation as to its actual condition without an instrumental examination of every inch of the ground, some idea may be gathered of the difficulties with which we have been confronted.

Two routes through the last mentioned region had been proposed by previous surveys; and it was the object of the association to make a thorough examination of the entire area so as to eliminate all doubtful questions, and, with a perfect knowledge of all the conditions involved, to select that route presenting the greatest facilities for the construction of the canal, both in regard to the economy and permanency of the work.

One of the routes extends on a nearly direct line from Ochoa to Greytown, and has been designated the "Upper route" by reason of its being located in the upper part of the valley and its most striking feature of retaining and extending the summit level to within a short distance of Greytown itself.

The other is known as the "Lower route," since it descends to the valley level of the San Juan a short distance below Ochoa, stretches along and at several points runs in close proximity to the bank of the river, until it reaches Punta Petaca, above the San Juanillo, where it turns to the north, and by a straight line reaches Greytown at about the same point as the "Upper route." This route was located by the United States surveying expedition of 1872-'73, and the former was the result of my surveys of 1885, conducted by order of the same Government. The work of relocation was undertaken for both routes from end to end with the whole force of the expedition, previous explorations and surveys being ignored except for the information to be derived therefrom and for purposes of comparison, the object being to improve, if possible, on what had already been done. It required the constant labors of six surveying parties, and the boring party six months, before the location of the two routes had been elaborated and advanced to the point where a fair comparison of their relative merits could be made; and, since the selection of the "Upper route," two parties have been engaged for five months in perfecting the location and gathering such a mass of valuable information as to leave no doubt whatever regarding its superiority, and the amount and character of all the work involved in the construction of the canal. No problem has been left unsolved, and what is now presented as the result of these arduous labors is an actual representation of the *natural conditions*.

THE PROPOSED ROUTE.

The proposed route from the Atlantic to the Pacific is in general direction and, with but slight modifications, identically the same as that proposed by me in 1885. The changes introduced consist principally in the addition of two new basins, and the extension of free navigation in the San Francisco Basin, by which the length of canal in excavation has been considerably reduced, with proportionally increased facilities to navigation, and the problem of draining the country traversed by the canal satisfactorily solved.

San Juan del Norté (Greytown) on the Atlantic, and Brito on the Pacific, are the termini of the canal, the total distance from port to port being 169.448 miles, of which 26.783 miles will be excavated canal, and 142.659 miles free navigation by Lake Nicaragua, the river San Juan, and through basins in the valleys of the streams Deseado, San Francisco, and Tola. Lake Nicaragua is necessarily the summit level of the canal, and its elevation above mean sea level is taken at its mean as 110 feet. It will be connected with the Pacific by two sections of canal in excavation and the Tola Basin, and with the Atlantic by slack-water navigation through the valley of the river San Juan, and a series of basins in the valleys of the San Francisco and Deseado, connected by short sections of canal, the sea level on each side being reached by three locks which have been located as near as possible to the extremities of the canal, viz, 3½ miles from Brito and 12¾ miles from Greytown, thereby giving a clean summit level of 153½ miles in extent out of a total distance of 169½ miles, as stated above. For the purposes of this report the whole route has been divided into four divisions, viz, eastern, San Francisco, Lake and River, and western.

Eastern division.

[From the inner harbor of San Juan del Norté (Greytown) to the San Francisco Basin, 18.864 miles.]

The line selected and located starts from the inner harbor of San Juan del Norté, and extends in a southwesterly direction for a distance of 9.297 miles to Lock No. 1, in the valley of the small stream Deseado, which descends from the high ridge separating the valley of the San Juanillo from that of the Caño San Francisco. Where the stream Deseado interferes with the course of the canal it is to be diverted by artificial channels. The first 9.297 miles of canal will be at the level of the sea, forming, practically, a prolongation of the harbor of Greytown, the width proposed allowing ample room for the passage of vessels going in both directions. The excavation will be entirely through flat alluvial deposits, as shown by the numerous borings taken along the whole line.

The first lock from this reach will have a lift of 30 feet, and the uniform dimensions of chamber adopted for all the locks, viz, 650 feet long and 70 feet wide. A suitable bit of high ground for the site of the lock is met with in the lower valley of the Deseado. From the head gate of Lock No. 1 to Lock No. 2 the canal follows the valley of the Deseado, which is here partially flooded by the construction of four low embankments connecting the site of Lock No. 1 with the sides of the valley. In this manner the canal excavation, which here consists chiefly of a stiff, red clay, underlying a thin strata of loam, is much reduced, and the drainage economically and efficiently controlled by suitable weirs of maximum flood capacity.

Lock No. 2, located 1.258 miles above the head gate of Lock No. 1, has a lift of 31 feet and will rest on solid ground, a hill on the south side of the valley affording an excellent site for it.

Lock No. 3, with a lift of 45 feet, is located 12¾ miles from Greytown and 1.927 miles from the head gate of Lock No. 2. This section of the canal occupies the lower basin, made in the valley of the Deseado by the erection of a dam 38 feet high and 1,300 feet long across the stream, and two embankments of an aggregate length of 1,400 feet and about 20 feet high on the top of the confining ridges. The only excavation needed through this basin is in cutting across three low hills of red clay.

At this point the valley of the Deseado is spanned by an embankment 70 feet high and 1,050 feet long, resting on two high hills, and the gaps on the ridge connecting this embankment with the sides of the valley are closed with smaller embankments, aggregating 5,800 feet on the crest, with an average height of 20 feet to the level 112 feet above sea level. By this means a basin 3.086 miles long is created in the valley of the stream, in which a depth of from 30 feet to 70 feet is obtained, without excavation, for a distance of 2.598 miles. It is proposed to retain the water in this basin at an elevation of 106 feet above sea level; in other words, the summit level of the canal is carried across the "divide" and extended to Lock No. 3, or to within 12¾ miles of the Atlantic, and but 3½ miles from the sea level, which, as stated above, reaches 9¼ miles up from Greytown. The advantage of these two large reservoirs in close proximity to the locks need not be commented upon, and the facilities afforded as a "turn out" for ships in waiting and traveling in opposite directions can not be overestimated. The dam is proposed to be built of stone, or what is termed "rock fill" with earth backing, and will have a weir 600 feet long on the crest, and a fall of 45 feet, for the discharge of the surplus water into the lower basin. This will be supplemented by another weir 800 feet long located on the south side of the valley in a gap between the hills inclosing the upper basin, giving a total length of weir of 1,400 feet.

At the western end of this basin begins the "eastern divide cut" connecting the valley of the Deseado with that of the Caño San Francisco. This cut is 2.917 miles long, has a maximum cut of 298 and an average depth of 111.2 feet above the level of the water, the depth in the canal being 30 feet, and contains about 21 per cent. of the total excavation estimated for the whole canal.

The magnitude of this work grows less striking as we proceed to examine its importance as a factor in the solution of the problem, the local advantages for its execution, its permanency when finished, and the advantageous and economical disposition of the material to be excavated.

First. It will be observed that this cut is almost in a direct line between Ochoa and Greytown, which are the two objective points of the canal; the former being the point at which it must of necessity leave the San Juan River, and the latter equally necessary at its terminus on the Atlantic.

Second. It is the lowest point along the whole ridge which intervenes between those two points, and nearly equidistant from each.

Third. It is also the narrowest pass, by several miles, of any other on the ridge, the valleys of the Deseado on one side and the San Francisco on the other here penetrating it further than elsewhere, thus allowing the greatest possible extension of their basins with the least excavation.

Besides the above there are several other important advantages connected with this particular pass entitled to much consideration.

First. The material to be removed is in the main solid rock, therefore the volume of excavation is reduced to a minimum, and the cut when made will remain so forever without further expense.

Second. The material is needed for the construction of the dam at Ochoa, for the embankments between Ochoa and Greytown, for the construction of the locks, for the breakwater at Greytown, and for pitching the sides of the canal, and whatever is left over can be dumped in the immediate vicinity.

Third. The center of distribution is most conveniently located, and were not this material available, at the sole expense of transportation down grade, it would have to be obtained at considerable cost from quarries in the vicinity, as there is no rock easy of access between Ochoa and Greytown, except in this ridge.

Fourth. The locality is one of the healthiest in Nicaragua, the drainage is perfect, and water abundant and excellent for domestic uses.

Fifth. There is close at hand on both sides of the ridge an inexhaustible water power for the economical and convenient operation of all the machinery required to do the work.

Posessing, therefore, as it does, this truly marvelous coincidence of favorable circumstances, it would seem as though the very hand of Nature had made this particular spot with the view of facilitating the execution of the greatest undertaking of this or any other age. With proper appliances and good management, so much of the work in the adjacent sections being dependent upon the material to be got from this cut, an even rate of progress can easily be maintained and the whole work be pushed to completion well within the six years estimated as the time for completing the canal.

San Francisco division 12.500 *miles.*

[From the western end of the Divide Cut to the river San Juan at Ochoa.]

On the western slope of the Divide the canal follows the valley of the Limpio for 1,477 miles to the end of the Cut. Before falling into the San Francisco basin it passes for .738 miles through a rolling country into the lower valley of the Limpio, the average depth of the cutting for this distance being 16 feet above the bottom of the canal.

Passing into the basin of the Caño San Francisco it follows the valleys of the Limpio and Chanchos to near the confluence of the latter with the San Francisco, and then up the valley of the stream, skirting the hills on the west to a favorable pass in the range separating this valley from the swampy region, called Florida Lake, extending towards Ochoa. The line of location follows this swamp to its western extremity, where it strikes the high rolling country intervening between this low region and he valley of the Machado; and following a tributary of the latter, it strikes the river San Juan 1,600 feet above the mouth of the Machado. The distance from the western end of the Divide Cut to the bank of the river San Juan is 12.500 miles, of which 7.481 miles are tangents and 5.019 miles comprised in eleven curves of from 4,000 to 11,459 feet radius. The hills surrounding the basin on the south do not form an unbroken range rising at all points above the level of the water, which in this section also is maintained at 106 feet above sea level. Eight gaps will have to be closed by embankments aggregating in length to 2,440 feet measured on the valley floor, and 12,260 feet on the crest, the maximum depth being 60 feet below the level of the water in the basins.

In addition to the above, 59 smaller embankments, aggregating in length 18,280 feet on their crest, rising 6 feet above water level and varying in height from 1 to 50 feet, will be required from Ochoa to the main ridge of the Divide. All the embankments resting on the valley or swamp level are designed of rock fill and earth backing, with three parallel rows of sheet piling between abutments.

The total length of basin secured by this plan is 11.267 miles from flowage line to flowage line, of which 8.697 miles is in water varying from 30 to 60 feet in depth. That is, of the 12.500 miles in the division, but 1.233 miles will be wholly and 2.570 miles partly in excavation. This is not, however, the only advantage gained by the creation of this basin. Without it the cut across the "Divide" would be of such proportions as to make the route commercially impracticable, and the basin of the Deseado an impossibility. Not less important are the additional considerations of free navigation through a wide and deep basin, instead of a restricted excavated channel. In the former vessels can travel at full speed, lie at anchor or pass each other at all points, while in the latter the position and speed of all ships must conform to rigid regulations.

Attention is also invited to another striking feature of this work, as compared with that close to the bank of the San Juan.

In a country subject to observed rainfalls of more than six inches in 24 hours, the problem of drainage involves dealing with forces of Nature whose enormous destructive powers are a constant menace to engineering works, however careful and skillful their design and execution. And it is of the utmost importance, therefore, to reduce these forces to a minimum before the construction of works to withstand them. The large territory embraced between the ridge confining the basin to the south and the "Lower Route" is, by the adoption of the "Upper Route," entirely eliminated from the problem of drainage, leaving only that portion of the watershed north of the ridge from the Divide to the valley of the Machado to be provided for. The area of this catchment basin is about 65 square miles.

It is proposed to build all embankments across the valleys in the disconnected portions of the ridge of "rock fills" and earth backing, the crest to be 107 feet above sea level, and with the top and outer slope so shaped and paved with large stones as to admit the free flow of water over the surface without danger of injury, all other embankments to be 112 feet above sea level. All these embankments will be, in fact, so many waste weirs for the discharge of the surplus water at several points in the basin, with an aggregate length of 4,720 feet of spillway and assuming that the embankments are perfectly tight, which will not be the case until several years after construction, and therefore that all the surplus water passes over the weirs the maximum thickness on the crest will not exceed 15 inches.

An extraordinary freshet in the San Juan above the dam would probably cause some of the river water to flow towards the basin, but it will be observed that the weirs in the basin alone are capable of discharging 90,200 cubic feet per second before the water reaches the top of the higher embankments, and that, in such extreme cases, the basin would also be discharging through the divide cut, over the Deseado Dam and weirs, and, if need be, through the culverts of Lock No. 3. As an additional precaution, a guard gate is provided in the first cut east of the Machado, by which the waters of the river San Juan may be shut off from the basin. With these ample provisions the destruction of the smaller earth embankments by an overflow of the basin seems to be well guarded against.

Lake and river division, 121.04 *miles.*

[From Ochoa to the western coast of Lake Nicaragua.]

This division extends from the western extremity of the San Francisco division in the valley of the Machado to the entrance of the canal on the west shore of Lake Nicaragua. The total distance is 121.04 miles, divided as follows: Navigation by the river San Juan, 64.54 miles; Lake navigation, 56.5 miles. The section of the river from Ochoa to the lake is to be made navigable by the construction of a dam at Ochoa, just below the Machado, maintaining the water at the summit level of 106 feet above sea level. It may here be explained that this elevation, hitherto treated as the summit level, is 4 feet below the lake, a fall of three quarters of an inch to the mile being allowed for the slope necessary to discharge its waters, although, for all the purposes of navigation, that portion of the river is converted into an extension of the lake.

The dam is located between two steep hills, and its length of weir on the crest will be 1,250 feet, and abutments 650 feet. The average depth of the water in the river was at the time of the survey 8 feet, and the maximum depth, close to the southern abutment, 14 feet, the width between banks being 950 feet. With a mean flow in the river of 20,000 cubic feet per second, the thickness of water on top of the weir will be about 3½ feet.

The dam is proposed to be built of rock fill and earth backing, in all respects similar to all the other large embankments and weirs already described. Its average height above the river bottom is 61 feet, its thickness at the top 25 feet, and at the bottom 500 feet. The core of the rock portion will be made of smaller stones, gravel, and refuse from the rock cuts, with three rows of sheet piling from abutment to abutment, and substantial concrete core walls from the ends of the sheet piling carried well into the abutment hills and up along the slope beyond the maximum flood level. The upper portion and long flat apron will be composed of stones of the largest dimensions that can be properly handled and arranged, the interstices being filled from behind with small stones, gravel, and earth dumped from suitable trestles.

By this dam, slack-water navigation in the river San Juan will be obtained in the whole distance from the lake, in which, with the exception of the 28 miles above Toro Rapids, the navigable channel will be at no point less than 1,000 feet wide, with depths varying from 28 to 130 feet. Between the Lake and Toro Rapids, rock blasting under water and dredging to an average depth of 4½ feet will be required at several places, amounting in all to 24 miles, most of the rock blasting occurring at Toro. The average depth of water as raised by the dam over the shallow places, where deepening has been estimated for, is 23 feet, and the excavated channel is 125 feet at the bottom, the slopes varying with the character of the material.

A further important effect of the dam will be to raise the water of the river San Carlos to the level attained by the San Juan at their confluence above Ochoa, converting the valley of that stream into a spacious lake or port, and an integral part of the summit level and of the canal itself. Thousands of square miles of the territory of Costa Rica now inaccessible by land or water will thus become the richest portion of that Republic; and the sediment now being brought down by the rapid current of the river will then be deposited, for want of transporting power, at the mouths of the ravines and mountain torrents emptying into the basin. In fact, the area now scoured will be so much reduced that comparatively little material will be transported.

The confining ridge to the east of the valley of the San Carlos is a generally high range extending in a nearly straight line from the south abutment of the Ochoa Dam about S. 15° W. 7½ miles to the foot of the high mountains of the interior. The length of the ridge following its crooked crest line is about 10 miles. The hills forming the ridge do not form an unbroken range at all points higher than the level of the water which is here also maintained on 106 feet above sea level. A number of short depressions will have to be closed by embankments, the tops of which will be at an elevation of 112 feet.

The total number of embankments necessary is twenty-one. Of these eight will be very small, the ridge being now above the water line but below 112 feet. Only two will reach the floor of the valley, having a depth of 48 feet. The remaining eleven have an average depth of 19 feet. The aggregate length of embankments on crest is 5,540 feet; on floor of valley, 130 feet.

The embankments proposed will be entirely of clay, 15 feet wide on top, with slope of 3 to 1 on both sides.

It is proposed to build a large waste weir in the ridge about 2¾ miles from the Ochoa Dam. This weir having its crest of 106 feet elevation will discharge the flood waters of the San Carlos into the San Juan independently of and below the dam.

The valley of Cureño Creek runs directly from the site of the proposed weir to the San Juan, 5½ miles below Ochoa, hence no channel for the discharged waters need be provided.

In the east side of Lake Nicaragua dredging in soft mud will be needed for a distance of about 14 miles to reach the depth of 30 feet, the average depth of the cut being 9.8 feet, and the proposed channel 150 feet wide at the bottom, with side slopes of 3 to 1 to the present bottom of the lake.

From the end of this cut to within 1,400 feet of the west coast, at the entrance of the canal, the depth in the lake varies from 30 to 150 feet. The excavation on the west side is estimated as rock. No borings were taken on this side of the lake, but the indications on the shore and the result of the borings in the vicinity point to rock as predominating in the submarine excavation.

In view of the nature of the bottom and the prevailing winds on that coast of the lake, it has been deemed advisable, if not essential, to estimate for two crib piers or breakwaters at the entrance of the canal and extending to deep water, a distance of 1,800 feet and 2,400 feet, respectively. These piers will have the effect of arresting débris traveling along the coast by the action of the waves, insure smooth water at the entrance of the canal, and serve as guides to approaching vessels.

Western division.

[From the lake to Brito, 17.04 miles.]

This section of canal connects the lake with the Pacific Ocean. It is 17.04 miles long from the shore of the lake when at 102.5 feet above sea level, the elevation at the time the surveys were made, to the port at Brito.

As the canal is now estimated for, 11.44 miles of that distance will be wholly in excavation and 5.60 miles through a basin in the valleys of the rivers Grande and Tola.

In this basin from 30 to 70 feet of water can be had for a distance of 4,568 miles. The basin has an area of 4,000 acres, an extreme width of 12,500 feet, and an average of 5,500 feet. An alternative route has been located through the valleys proposed to be flooded, for a canal in excavation, should it be found more economical on account of the value of the land through which it passes. The only new feature of this division is the basin now introduced.

The first section begins at the mouth of the river Lajas, on the west shore of Lake Nicaragua, and follows the valley of that stream for a distance of 8,260 feet, in which the width of the canal is 120 feet at the bottom and the side slopes 1½ to 1, both in rock and earth. The river Lajas here turns to the south, and it is proposed to divert it and make it discharge into the lake a short distance south of its present mouth. The canal continues on the same straight line, crosses a plain about three-quarters of a mile wide, and enters the valley of the Guiscoyal, a small tributary of the Lajas, and at 4.70 miles from the lake it crosses the highest elevation on the line between the lake and the Pacific. This point is 42 feet above high lake, or 152 feet above mean tide in the Pacific, and is situated in a valley about 2 miles wide, deserving special mention by reason of the fact that it is the lowest depression of the main ridge between the Atlantic and Pacific Oceans on the American continent.

After crossing this divide the line gradually descends at the rate of about 9 feet per mile and in 1¾ miles further it meets the Rio Grande, a mountain stream which drains an extensive area of the western slope of the Cordillera. The line of the canal follows the tortuous channel of the Grande, cutting across some of its sharp bends or occupying the channel in short reaches. In 1½ miles it frees itself from this contracted valley and cuts across a broad plain as it turns to the westward, and enters the basin of Tola 9 miles from the lake. The distance across the basin by the sailing line is 5.504 miles. This basin is formed by the construction of an embankment 1,800 feet long and 70 feet high, resting on two high hills at a place called La Flor. The method of construction of this embankment is in all respects similar to that adopted for the construction of the Ochoa Dam and embankments in the San Francisco Valley. The rock for the fill will be obtained from the excavations for Locks Nos. 4 and 5 in the north abutment, and the earth from the canal excavation east of the basin. The level of the lake will be extended through the divide cut and the basin to this dam, the top of which is established at 112 feet above sea level. Therefore the lake will have to rise more than 2 feet above the proposed summit level before any water runs over the weir. With a length of weir of 1,300 feet and the lock culverts capable of discharging not less than 4,500 cubic feet per second, the level of the lake can be kept under control, even in extraordinary floods. Yet a guard gate is proposed in the section of canal between the lake and the divide to shut off the water from the lake in case of necessity. No special provision has been made for the control of the rivers Grande and Tola, and none is deemed necessary. These streams will flow into the summit level, one between the lake and the Tola Basin, and the other at the northern extremity of the basin. The waters will be distributed between the basin and the lake or partly used for feeding the locks, and should both rivers be in flood while the water in the basin is below the crest of the weir, and therefore most of the combined flow discharging into the lake, the current in the canal through its narrowest portion in the divide will not exceed 2 miles an hour, which can do no harm in the rock cut, while in the larger portions of the canal the velocity would, of course be proportionally less.

From the western end of the valley of Tola to Brito, the canal, after leaving Locks Nos. 4 and 5, cuts across a broad, flat country, with an inclination of about 9 feet per mile, to the port, a distance of 2.28 miles, in which the excavation does not exceed that required for the canal prism.

These locks are proposed to overcome the difference of level between the summit and the Pacific. Locks Nos. 4 and 5 are located in the hill north of La Flor dam; their chambers are 650 feet long and 70 feet wide and the lifts 42¼ feet in each. Lock No. 6, of the same dimensions of chamber, is situated 1.58 miles below, its lifts being 21 feet and 29 feet, respectively, at high and low tide. Between this lock and the port of Brito, a distance of 0.57 mile, the canal will be at the level of the sea, with an enlarged section, and may be regarded as an extension of the harbor similar to that at the Greytown end of the route.

HARBORS.

Greytown.—The observations and surveys conducted by the hydrographic party and subsequent investigations by other engineers of the company have fully confirmed the theory based on previous surveys as to the nature and magnitude of the forces which caused the destruction of this harbor and consequently the plan heretofore recommended for resisting these forces and restoring the harbor is now adhered to with but slight modifications in the details.

The plan of restoration involves the construction of a jetty or breakwater 1,700 feet long, nearly normal to the shore of the outer bar and extending to the 6-fathom curve, and dredging from this latter depth offshore across the sand bank now closing the harbor and in the inner bay. The jetty is located to the windward of the excavated channel which it is intended to shelter from the sea and protect from the wash of the waves and the traveling sands of the coast.

The first section of the jetty, extending from the shore to 15 feet of water, is proposed to be built of creosoted timber, fascinage, and stone, and that portion in deep water to be of "pierre perdue" or rubble, the stone to be obtained from the divide cut. The entrance channel is estimated to have a depth of 30 feet and a width of 500 feet at the bottom, and the inner basin is designed of sufficient dimensions to afford easy access to the canal and to accommodate a large number of vessels, its excavated area on the bottom being 206 acres, which, with the area of the enlarged section of the canal at sea level to Lock No. 1, gives a total area of 341 acres of water 28 feet deep, exclusive of slopes of 3 to 1 and the remaining portions of the inner bay not deepened, yet having in many places a depth of 20 feet, in which a large number of vessels of ordinary size can lie.

Brito.—The recent surveys have greatly added to previous information as to the natural conditions of this locality, which by reason of its being of necessity the terminus of the canal on the Pacific coast, has been spoken of as "the harbor," when, as remarked by Professor Mitchell, it is not even a roadstead. Yet the practicability of constructing a harbor at this point has not been disputed, the only difference of opinion being confined to details. The plan now proposed combines as nearly as possible the most economical form of construction with that best adapted to the physical conditions, and meets, it is believed, most effectually the objections raised against former designs.

The broad valley of the Rio Grande stretches to the coast at this point through a wide gap in the main range of hills extending along the Pacific coast. This valley, it is believed, formed once a considerable bay, but is now filled up for a distance of about 6,000 feet from the beach to about the level of high water. The proposed plan for the construction of the harbor consists, first, in a breakwater 900 feet long, extending from a rocky promontory projecting from the beach at the western extremity of the range of hills, and second, another jetty 830 feet long, normal to the beach nearly opposite the extremity of the one before mentioned. The proposed harbor will be partly in deep water confined by the jetties, but its main portion is proposed to be excavated in the alluvial valley, the whole forming a deep and broad basin penetrating 3,000 feet from the present shore line at high water and 3,900 feet from the entrance between jetties. As an extension of the harbor, the canal itself is excavated at sea level with an enlarged prism for a distance of 3,000 feet further inland, where the tide lock has been located. It is believed that with the basin as designed and the prolongation of the sea level through the canal sufficient tranquillity will be secured at the lock and in the harbor, but should this prove not to be the case an enlargement of the main basin by dredging in soft material would be a question of but comparatively small expense.

The breakwaters as estimated for are of "pierre perdue," the material to be obtained from the rocky promontory or from the western divide cut, the price allowed being on the latter basis. The harbor has an area of 95¼ acres on the bottom or excavated portion, and with the sea-level section of the canal the total area is 103¾ acres of water, 30 feet deep, exclusive of the slopes of 3 to 1.

MATERIALS FOR CONSTRUCTION.

As has been stated in previous reports the whole line of the canal is well supplied *with timber, generally* of excellent quality, though in some sections of the eastern division it has been deemed advisable to estimate for its use only on temporary works during construction, such as trestles, laborers' dwellings, etc., the sheet piling and most of the bearing piles being imported from the Southern States and creosoted where necessary. On the western division, however, the wood growing on ground less moist is of a very superior quality and it is proposed to use it for all purposes, its durability having been amply proved in every class of construction throughout the country.

The rock proposed to be used for the dams, weirs, and breakwaters will be got from the divide cuts, which consist chiefly of basalt and various descriptions of trap of excellent quality for the purpose.

Lime of the best quality is obtainable in the western division at many places and the numerous specimens of work on which it has been used have stood the test of many generations and are to-day in a state of preservation, but it is calculated to supplement this supply with imported cement, which will be used largely in the form of concrete in the construction of locks, etc., clean sharp sand being found in great abundance in the beds of most of the streams in the vicinity of the canal.

DIMENSIONS AND CAPACITY OF THE CANAL.

In establishing the dimensions of the canal it has been my purpose to profit by the experience of the Suez Canal, where a yearly traffic of 6,000,000 tons could not be carried through without serious delays to navigation. The reduction in the length of excavated canal accomplished by the last location in Nicaragua through the substitution of free navigation in deep and broad basins for a restricted channel, gives additional facilities for the construction of a water way capable of accommodating not less than 12,000 vessels with a net tonnage of 20,000,000 a year at but a small increase cost as compared with the advantages secured, both for the commerce of the world and the economical administration of the enterprise. In fact, the immediate and prospective benefits obtained by the enlargement, in the increased facilities for passing vessels and a considerable decrease in the cost of maintenance and preservation of the work, fully justify, it is believed, the additional expense in the original cost. It will be seen on examination of the subjoined table that, of the 169.448 miles, the total length of the canal from the Atlantic to the Pacific, 121.04 miles is unimpeded navigation in the River San Juan, and in Lake Nicaragua, and 21.619 miles through basins, making a total distance of 142.659 miles in which ships can travel with little or no restriction as to speed. Of the remaining 26.789 miles, .759 is taken up by the six locks leaving but 26.030 miles of canal actually in excavation. Of this latter distance 18.189 miles are of canal large enough for vessels traveling in opposite directions to pass each other, the sectional area being in excess of the largest area of the Suez Canal. The two sections of canal with contracted prisms are in the eastern and western divide cuts; the first is 2.917 miles and the other 4.924 miles in length and located as they are almost at the extreme ends of the summit level, and in close proximity to the upper locks it is believed that the slight additional facilities to navigation secured by enlarging the dimensions of the canal in these heavy rock cuts, and the inconsiderable gain in the time of transit would not compensate for the larger outlay necessary.

Table showing the dimensions of the several sections of the proposed canal.

Section of canal.	Length.	Width, top.	Width, bottom.	Depth.	Area of prism.
	Miles.	*Feet.*	*Feet.*	*Feet.*	*Sq. feet.*
Greytown to Lock No. 1	9.297	288	120	28	5,712
Lock No. 1 to Lock No. 2 (canal)	1.258	210	120	30	4,950
Lock No. 2 to Lock No. 3 (canal)	1.65	210	120	30	4,950
Lock No. 2 to Lock No. 3 (basin)	1.762	....	....	*30	....
Lock No. 3 to western end of eastern divide cut (canal)	2.917	80	80	30	2,400
Lock No. 3 to western end of eastern divide cut (Desеado basin)	3.086	....	....	*45	(†)
Western end of divide cut to Ochoa (canal)	1.233	184	80	30	3,673
Western end of divide cut to Ochoa (San Francisco basin)	11.267	....	....	40	(†)
River San Juan to Toro Rapids	37.040	....	....	*52	(†)
River San Juan where dredging is needed	27.500	....	125	*28	(†)
Lake Nicaragua	56.500	....	150	*50	(†)
Lake to western divide cut (canal)	1.565	210	120	30	4,950
Western divide cut (canal)	4.924	80	80	30	2,400
Divide cut to east end of Tola basin (canal)	2.519	184	80	30	3,673
East end of Tola basin to Lock No. 4 (basin)	5.504	....	....	*50	(†)
Lock No. 5 to Lock No. 6 (canal)	1.582	184	80	30	3,673
Lock No. 6 to harbor of Brito, (canal)	.570	288	120	28	5,712

* Mean. † Undetermined.

RECAPITULATION.

	Miles.
Canal in excavation, east side	14.870
Canal in excavation, west side	11.166
Six locks, both sides	.753
Total canal in excavation	26.789
Basins of the Deseado	4.848
Basin of the San Francisco	11.267
Basin of the Tola	5.504
Total length of basins	21.619
River San Juan	64.540
Lake Nicaragua	56.500
Total natural water ways	121.040
Total length of canal (from the Atlantic to the Pacific)	169.448

In the lake and in the greater part of the River San Juan vessels can travel with unrestricted speed, and in some sections of the river and in the basins, although the channel is at almost all points deep and of considerable width, yet the speed will be somewhat checked by reason of the curves.

Official reports show that, in the Suez Canal, steamers of 4,400 tons can travel at an average speed of 6 statute miles per hour, and that smaller vessels travel through the canal at the rate of from 6 to 8 miles an hour. On this basis the following estimate of the time of transit has been prepared:

Estimated time of through transit by steamer.

	H.	M.
26.030 miles of canal, at 5 miles an hour	5	12
22.619 miles in three basins, at 7 miles an hour	3	05
64.540 miles in the River San Juan, at 8 miles an hour	8	04
56.500 miles in Lake Nicaragua, at 10 miles an hour	5	39
Six lockages at forty-five minutes each	4	30
Allow for detentions in narrow cuts	1	30
Total time of transit	28	00

The traffic of the canal will be limited by the time required for a vessel to pass a lock, and on the basis of forty-five minutes, and that but one vessel will pass in each lockage, the number of vessels that can pass through the canal in one day will be 32 or in one year 11,680, which at the average tonnage of vessels going through the Suez Canal, will give an annual traffic of 20,440,000 tons. This estimate is on the assumption that the traffic will not be stopped during the night, for with abundant water power at the locks and at the basins the whole canal can be economically illuminated by electricity, and with beacons and range lights in the lake and river there seems to be no good reason why vessels should not travel day and night with perfect safety, and the outlay necessary for the illumination has consequently been included in the estimates.

Water supply.

Lake Nicaragua has a surface area of about 2,600 square miles, and a watershed of not less than 8,000 square miles. Gauges of its outlet, the River San Juan, at its lowest stage between the lake and Toro Rapids showed a minimum flow of 11,390 cubic feet per second. Colonel Childs estimated the discharge with full lake in the wet season at 18,059 cubic feet per second, which gives a mean flow of 14,724 cubic feet per second, or 1,272,530,600 cubic feet per day.

Water required for lockage.

	Cubic feet.
Water required for one lockage:	
On the east side	2,047,500
On the west side	1,933,750
On both sides	3,981,250
Water required for 32 lockages per day	127,400,000

This gives a daily excess for the lake supply *only* of 1,144,753,600 cubic feet.

To the latter amount must be added the flow of the several tributaries of the San Juan River between the lake and the Ochoa dam, and also the tributaries of the basins forming part of the summit level, which would fully compensate for leakage and evaporation.

It is expected that considerable leakage will take place at the rock-fill dams and embankments before they consolidate and become tight, but this may well be accepted as a desirable condition to aid in gradually disposing of the surplus water without a large discharge over the weirs.

The above statement shows that the lake discharge is abount ten times larger than the maximum amount needed for the canal, and it may be safely estimated that for many years after the canal is opened for traffic, the surplus from that source alone will be double that amount, while at the confluence of the rivers San Juan and San Carlos, above the Ochoa dam, the excess may even reach forty times the quantity needed for the canal. It is evident, therefore, that as long as the summit level can be maintained at the required elevation, the leakage through the rock fills, acting as safety valves, may be regarded as an element of security rather than one of danger, especially as the tightening of the dam can be regulated by depositing suitable material on the upstream side or by dumping more stone on the lower slopes or on the crest, so as to preserve the desired elevation of the surface of the water.

ESTIMATES.

The estimate of the cost of the canal, submitted with this report, is the result of careful computations of all the works required for the completion of the canal and its accessories, based upon the data obtained by the last location with numerous borings along the whole route. Where no rock was met with the borings were carried to the bottom of the canal, and all material which the auger or hand drills could not penetrate has been assumed to be, and estimated for, as rock. The result is a much larger amount of rock in proportion to the cube to be removed than had been estimated before; and although the length of canal in excavation has been reduced by 13.5 miles and the total amount of excavation by 3,567,565 cubic yards, in that portion covered by the report of 1885, yet the cost of that item of expense is now put down at $31,936,136.05 as compared with $33,447,338.80, in 1885. It is believed that when a more effective system of drilling is applied in certain portions of the line a much smaller amount of actual work will be found than now appears on the estimate. In the meantime the error, if any, is made on the safe side. The eastern "divide cut," of but less than 3 miles in length, is represented in the estimate with 7,000,230 cubic yards of rock in place and 22 per cent of the cost of the whole work, and reference has been made, in describing the eastern division, to the existing facilities for doing this work and to the several purposes to which the material to be removed can be advantageously applied in the construction of the canal for the expense of transportation alone.

In the western division the excavation in rock through the divide cut is estimated at 5,696,507 cubic yards in a distance of 9 miles, but that work presents no serious difficulties, the maximum depth of excavation being only 42 feet above the surface of the water in the canal, and the mean only 20 feet, with ample facilities for disposing of waste material not needed for the construction of the breakwaters, the locks, the embankments, and pitching the slopes of the canal.

A comparison of the figures given in the estimate with those of the 1885 report discloses what at first sight appears to be an inconsistency, viz, an increase in the total estimated cost of the canal of $1,047,978.25, and a decrease in the length of actual canal to be excavated of 13.5 miles, and in the cube to be removed of 3,567,565 cubic yards, as stated before. It will, however, be observed that the surveys made by the expedition of 1885 were confined exclusively to the land portions of the canal, the estimates for the other portions being based on previous incomplete hydrographic surveys, while the recent location, covering, as it does, the whole line from ocean to ocean, has produced the following results:

First. A reduction of the quantities in all the sections actually located by the 1885 expedition, by the introduction of basins, etc., and certain modifications in detail in the location, thus: 54,015,602 cubic yards excavation in canal proper in 1885 report, and 50,448,037 cubic yards by present estimate, a difference of 3,567,565 cubic yards in favor of the new location; though, with regard to cost, this has been more than balanced by the increase in the proportion of rock now estimated, as already explained.

Second. In all the work connected with the lake and harbor of Greytown the increase in consequence of the more accurate data now obtained is, for excavation in the lake 4,902,908 cubic yards, against 877,675 cubic yards in 1885, and in the harbor of Greytown 9,550,000 cubic yards, against 4,080,100 cubic yards. Besides the addition of certain other improvements, which have been spoken of in the body of this report, fully explaining the apparent contradiction between the claims and the results of the recent expedition, and giving further evidence of its extensive scope as well as its minute attention to detail, making it, as claimed, an improved location, the estimated cost only increased by more accurate knowledge of the country and conditions.

Of the 26,789 miles of canal in excavation, more than 12 miles will be done by dredging, the material to be deposited directly on both sides of the cut, and the short cuts in the San Francisco division, amounting in the aggregate to 1¼ miles, are subdivided in small sections across narrow ridges separating deep valleys, where the excavated material not needed for embankments, can be dumped in the immediate vicinity.

A railroad has been estimated for from Lock No. 1 to the dam at Ochoa, and between Lake Nicaragua and the Pacific, which, together with the lake and river and the smaller streams penetrating into the valleys of the Deseado and San Francisco, will afford easy and economical communication along the whole route. These small streams will be of special value at the start, as they proved to be in the prosecution of the surveys. It is admitted that the prices adopted in estimating the cost of this work should be greater than would be required for similar work located in any well-developed section of this country. A large percentage of the increased cost is chargeable to the transportation of tools and machinery, and to the difficulty in obtaining and providing for the workmen, the country from Greytown to the lake being uninhabited, and that between the lake and Brito but sparsely populated. The erection of houses for the protection of the property and accommodation of employés will be a necessary item of expense; but the country is exceptionally healthy, and these structures need not be either substantial in character or expensive. The majority need be but temporary sheds built with material gathered along the line of the canal, at but little more cost than the labor in handling it; yet, some delay and expense may be found unavoidable in the preliminary preparations for commencing the work.

Another contingency which may cause a marked increase in the cost of the work is the physical inability of the imported workmen to perform the ordinary labor, as compared with that accomplished in a more temperate climate. The laboring classes of Nicaragua, when under proper control, are capable of an activity and endurance under great fatigue and exposure to the elements scarcely equaled in any other country, and with no apparent injury to health; yet the same capabilities can not be expected in unacclimated foreigners, accustomed to different conditions of life. It is believed that not less than 6,000 excellent laborers can be obtained from the Central American States, and that with a judicious management all the help needed can be had from the Gulf States in this country, where the climatic conditions are in many respects similar to those prevailing over a large portion of the canal route. The number of skilled laborers employed will be comparatively small. On the west side of the lake, where the greater number of laborers will be employed, the climate is not excelled for salubrity by any other portion of Central America, and in that portion of the eastern section from Ochoa to Greytown, which is the only locality where trouble from climatic causes might be expected, the unexceptional good health enjoyed by the employés of the company during more than six months of constant exposure to the influence of the climate, while undergoing all kinds of hardships and privations, seems to be an evident demonstration that no apprehensions need be entertained as to the climate. It will be observed that in this section the work is divided into two large classes, viz, the divide cut and dredging. The first is located in the most elevated and healthy portion of the line, and in the second the number of employés is reduced to a minimum, as manual labor is almost entirely excluded. The small force necessary to handle and care for the machinery will be either housed on the dredges or in quarters in the "divide" where, with the purest of waters from the mountain streams and the cool "trades" constantly sweeping in from the sea, the slightest sanitary regulations will insure perfect health at all times.

The prices adopted are believed to be ample to cover all possible contingencies, provided the work is conducted by an intelligent and business-like management.

It is estimated that the canal can be completed in six years, of which time one year will be expended in marking out the line, and clearing the ground, and in making the necessary preparations to commence active operations.

CONCLUSION.

In closing this report I beg to express my firm convictions, the result of several years of constant labor and careful investigations, that the route here described and recommended is perfectly practicable, free from complicated engineering problems, and the most economical as well as the safest for interoceanic ship communication between the Atlantic and Pacific Oceans, across the American Isthmus.

In making this location the information obtained by previous surveys and explorations has been utilized with much saving of time and labor, and has greatly contributed to the thorough knowledge of the country traversed by the canal now in possession of the company; and it may be safely stated that the present location can not be materially improved upon.

I take pleasure in expressing my high appreciation of the valuable services rendered by the officers of the expedition, to whose untiring energy and devotion to duty, under many adverse conditions, is due the success of the surveys. With such a large and efficient staff in which the prevailing sentiment of each seems to have been to excel in the discharge of his duties, it is not in my power to make individual references to merit, but my sincere thanks are extended to all; yet I feel confident I can make two exceptions with the unanimous approval of all concerned.

Subchief R. E. Peary, on whom devolved the onerous duty of taking the surveying expedition to Nicaragua, displayed from the moment of his arrival in the country the most untiring energy, perseverance, and ability in the proper management and distribution of the force under his charge, and in pushing the work forward, deserving the highest commendation. After I took charge of the work his coöperation was equally valuable.

The other is Mr. J. Francis Le Baron, who has been for the last six months in charge of the surveying parties left in Nicaragua, and has rendered very valuable services in completing and perfecting the location of certain portions of the route, where additional information was deemed necessary.

The medical corps rendered most important services both in attending to the sick and in giving preventive advice, which proved both valuable and effective. It shared also in the field work and in the draughting at headquarters.

Respectfully submitted.

A. G. Menocal,
Chief Engineer.

ESTIMATES OF COST ON LOCATION OF 1887-1890.

EASTERN DIVISION, 18.864 MILES.

[From Greytown to the eastern limit of the San Francisco Basin.]

Section 1—From Greytown to the Divide, 15.947 *miles.*

1,819.820 cubic yards excavation in earth above water, at 40 cents	$727,928.00
13,547,597 cubic yards dredging, at 20 cents	2,709,519.40
172,288 cubic yards stone pitching sides of canal, at $2	344,576.00
925 acres grubbing and clearing, at $100	92,500.00
Lighting canal (at one-half mile intervals), 24 incandescent electric beacons and plant	67,000.00
Lighting locks, 30 electric arc lights, with separate dynamos for each lock	9,000.00
	$3,950,523.40

Section 2—The Divide, 2.917 *miles.*

7,000,230 cubic yards excavation in rock, at $1.50	10,500,345.00
3,034,904 cubic yards excavation in earth, at 40 cents	1,213,961.60
169 acres grubbing and clearing, at $100	16,900.00
Lighting canal (at one-half mile intervals), 6 incandescent electric beacons and plant	8,500.00
11,600 lineal feet of narrow section of canal, to receive double fender wales each side, at $4	46,400.00
	11,786,106.60

Railroad and telegraphs.

12 miles railroad from Lock No. 1 to San Francisco Basin, at $60,000	720,000.00
22 miles telegraphs, Greytown to San Francisco Basin, at $500	11,000.00
	731,000.00

Lock No. 1.

463,603 cubic yards excavation in earth, at 40 cents	$185,441.20
120,044 cubic yards concrete (rock obtained from the Divide Cut), at $6	720,264.00
2,400 cubic yards stone pitching in basin, at $2	4,800.00
3,699 cubic feet fender wales, at 50 cents	1,849.50
1,020 fender piles 45 feet long, at $13.50	13,770.00
Gates	114,934.40
Machinery	100,000.00
Buildings	30,000.00
Pumping	100,000.00
	1,271,059.10

Lock No. 2.

308,918 cubic yards excavation in earth, at 40 cents	123,567.20
120,430 cubic yards concrete (rock obtained from the Divide Cut), at $6	722,580.00
2,400 cubic yards stone pitching in basin, at $2	4,800.00
3,699 cubic feet of fender wales, at 50 cents	1,849.50
1,020 fender piles 45 feet long, at $13.50	13,770.00
Gates	114,934.40
Machinery	100,000.00
Buildings	30,000.00
	1,111,501.10

Lock No. 3.

528,673 cubic yards excavation in earth, at 40 cents	211,469.20
147,627 cubic yards concrete (rock obtained from the excavation,) at $6	885,762.00
32 fender cribs, at $500	16,000.00
Gates	188,440.00
Machinery	100,000.00
Buildings	30,000.00
	1,631,671.20

Harbor of Greytown.

Brush and pile pier, 900 feet long	190,214.50
225,907 cubic yards stone in breakwater (from Divide Cut), at $1.50	338,860.50
9,550,000 cubic yards dredging in sand, at 20 cents	1,910,000.00
Piers at entrance to canal	100,000.00
Lighting and buoying:	
One first-order lighthouse complete	100,000.00
Three range beacon lights	1,000.00
One breakwater beacon light and signal tower	7,000.00
Two pier-head lights	2,000.00
One first class (middle channel) Nun buoy	200.00
Two second class (side channel) Nun buoys	200.00
Two third class (side channel) Nun buoys	100.00
	2,649,575.00

Auxiliary Works.

105,500 cubic yards dredging in earth and sand in diversion of Deseado, at 20 cents	21,100.00
Embankment and weirs in valley of the Deseado:	
210,625 cubic yards rock fill (from the Divide Cut), at 40 cents	84,250.00
836,329 cubic yards earth in embankments and backing of weirs, at 30 cents	250,898.70
79,658 cubic yards excavation of surface soil for embankments, at 40 cents	31,863.20
5,100 lineal feet of sheet piling, 30 feet long 8 inches thick, say 1,350,000 feet B. M., at $70	94,500.00
250,000 feet B. M. timber for cross-ties and guides for sheet piling, etc., at $60	15,000.00
200 bearing piles for trestles and guides to sheet piling, at $10	2,000.00
2,500 lineal feet of trestles, for dumping stone, etc., at $22	55,000.00
	554,611.90

RECAPITULATION, EASTERN DIVISION.

Section 1, from Greytown to the Divide	$3,950,523.40
Section 2, the Divide	11,786,106.60
Railroad and telegraphs	731,000.00
Lock No. 1	1,271,059.10
Lock No. 2	1,111,501.10
Lock No. 3	1,631,671.20
Harbor of Greytown	2,649,575.00
Auxiliary Works	554,611.90
	23,686,048.30

SAN FRANCISCO DIVISION, 12.500 MILES.

[From the western end of the eastern div de cut" to the River San Juan.]

725 acres clearing trees from line of canal, at $100	72,500.00
30,309 cubic yards excavation in rock, at $1.50	45,463.50
2,698.195 cubic yards excavation in earth, at 40 cents	1,079,278.00
Lighting canal at one-half mile intervals, 24 incandescent electric beacons and plant	65,000.00
Guard gate or movable dam to control waters of the San Juan	300,000.00
	1,562,241.50

Railroad and telegraphs.

15 miles railroad at $60,000	900,000.00
40 miles telegraphs, from Divide to Castillo, at $500	20,000.00
	920,000.00

Embankments and weirs in the valley of the San Francisco:	
3,239,705 cubic yards earth in embankments from canal excavation, at 30 cents	971,911.50
1,575,459 cubic yards rock fill from the "divide cut," at 40 cents	630,183.60
192,415 cubic yards excavation of surface soil for embankments, at 50 cents	96,207.50
12,600 lineal feet of sheet piling 40 feet long 8 inches thick, say 4,500,000 feet B. M., at $70	315,000.00
1,458 guide piles for sheet piling and for bearing trestles, average 30 feet long, at $8	11,664.00
524,000 feet B. M., of timber in guides and cross-ties for sheet piling, etc., at $60	31,440.00
27,585 lineal feet of trestles for dumping rock and carrying railroad, at $22	606,870.00
178 acres grubbing and clearing for embankments at $100	17,800.00
	2,681,076.60

RECAPITULATION, SAN FRANCISCO DIVISION.

Excavation, lighting, clearing, etc	1,562,241.50
Railroad and telegraphs	920,000.00
Embankments and weirs in valley of the San Francisco	2,681,076.60
	5,163,318.10

LAKE AND RIVER DIVISION, 121 MILES.

[From Ochoa to the western shore of Lake Nicaragua at the mouth of the Rio Lajas.]

Section 1—*Rio San Juan*, 64.5 *miles.*

398,613 cubic yards excavation in rock under water, at $5	1,993,065.00
422,540 cubic yards excavation in earth above water, at 40 cents	169,416.00
2,150,900 cubic yards dredging in earth at 30 cents	645,270.00
377 acres grubbing and clearing across bends at $100	37,700.00
Lighting and buoying:	
10 middle channel spar buoys (Fort San Carlos to Toro), at $25	250.00
80 western river light beacons, at $50	4,000.00
One electric arc lamp in signal tower at Dam	3,000.00
Three incandescent electric light beacons, at Dam basin	1,000.00
70 miles telegraphs, at $500	35,000.00
	2,888,701.00

Section 2—Lake Nicaragua, 56.5 miles.

176,832 cubic yards submarine rock excavation (west shore of lake), at $5	$884,160.00
4,726,076 cubic yards dredging (east side of lake), at 20 cents	945,215.20
Lighting and buoying:	
One fourth-order lens in signal tower at mouth of Rio Lajas	7,000.00
One 2-mile range beacon	100.00
One fourth-order lens in keeper's dwelling at end of Solentiname Island	9,000.00
One second-order lens on hill, old Fort San Carlos	80,000.00
One fourth-order range light in signal tower, old Fort San Carlos	7,000.00
One second-class (middle channel) nun buoy at mouth of Lajas	100.00
Two third-class (side channel) nun buoys at mouth of Lajas	100.00
Five third-class (middle channel) nun buoys at entrance Rio San Juan	150.00
	1,857,825.20

Dam across Rio San Juan at Ochoa.

18,500 cubic yards excavation in earth, at 40 cents	7,400.00
1,550 cubic yards concrete in core walls of abutments, at $10	15,500.00
830 bearing piles for trestles and sheet piling 45 feet long, at $13.50	11,205.00
3,330 lineal feet of sheet piling, 30 feet deep by 8 inches thick, 800,000 feet B. M., at $75	60,000.00
1,180,000 feet B. M. of timber in trestles, guides for sheet piling, cross ties, etc., at $60	70,800.00
807,920 cubic yards rock fill (from divide cut), at 50 cents	403,960.00
629,090 cubic yards earth filling from excavation at 25 cents	157,272.50
	726,137.50

Embankments on San Carlos Ridge line.

293,240 cubic yards earth in embankments (borrowed), at 70 cents	205,408.00
22,370 cubic yards excavation of surface soil, at 50 cents	11,185.00
450 lineal feet sheet piling 40 feet long, 8 inches thick, 144,000 feet B. M., at $70	1,510.00
45 guide piles for sheet piling, averaging 30 feet long, at $8	360.00
18,000 feet B. M. of timber in guides and cross-ties for sheet piling, etc., at $60	1,080.00
3½ acres grubbing and clearing for embankments, at $100	350.00
	219,893.00

RECAPITULATION, LAKE AND RIVER DIVISION.

Section 1, River San Juan	2,888,701.00
Section 2, Lake Nicaragua	1,857,825.20
Embankments in San Carlos Ridge Line	219,893.00
Dam across Rio San Juan at Ochoa	726,137.50
	5,692,556.70

WESTERN DIVISION, 17.04 MILES.

Section 1.—From Lake Nicaragua to Briton 17.04 *miles.*

5,696,507 cubic yards excavation in rock above water, at $1.25	7,120,633.75
5,399,316 cubic yards excavation in earth above water, at 40 cents	2,159,726.40
1,066,666 cubic yards dredging in sand, at 20 cents	213,333.20
20,753 cubic yards stone pitching sides of canal, at $2	41,506.00
1,033 acres grubbing and clearing, at $50	51,650.00
Lighting 20 incandescent electric beacons and plant	54,000.00
30 electric arc lights and two separate dynamos at locks	9,000.00
26,000 lineal feet of narrow section of canal to have double fender wales each side, at $4	104,000.00
	9,753,849.35

Diversion of the Rio Lajas into the lake.

249,508 cubic yards excavation in earth, at 40 cents	$99,803.20
164,786 cubic yards excavation in rock, at $1.25	205,982.50
	305,785.70

Railroad and telegraphs.

18 miles narrow-gauge railroad, at $25,000	450,000.00
18 miles telegraphs, at $500	9,000.00
	459,000.00

La Flor dam.

17 acres grubbing and clearing, at $50	850.00
320,000 cubic yards excavation of surface soil, at 40 cents	128,000.00
3,320 lineal feet of sheet piling in two rows, 30 feet long, 8 inches thick, 796,800 feet B. M., at $75	59,760.00
322 bearing piles for trestles and guiding sheet piling 20 feet long, at $5	1,610.00
50,000 feet B. M. of lumber for guides and cross-ties for sheet piling, at $50	2,500.00
1,600 lineal feet of trestles for dumping material, at $22	35,200.00
918,000 cubic yards earth from canal excavation, at 20 cents	183,600.00
830,000 cubic yards rock fill from excavation for locks, at 20 cents	166,000.00
	577,520.00

Locks Nos. 4 and 5.

664,194 cubic yards excavation in rock, at $1.25	830,242.50
127,646 cubic yards excavation in earth, at 40 cents	51,058.40
100,000 cubic yards concrete (rock from the excavations), at $6	600,000.00
1,020 fender piles, at $13.50	13,770.00
3,699 cubic feet fender wales, at 50 cents	1,849.50
2,400 cubic yards stone pitching in basin, at $2	4,800.00
Gates	250,000.00
Machinery	150,000.00
Buildings	45,000.00
	1,946,720.40

Tidal Lock No. 6.

61,698 cubic yards excavation in rock, at $1.25	$77,122.50
124,800 cubic yards excavation in earth, at 40 cents	49,920.00
126,000 cubic yards concrete (rock obtained from the Divide Cut), at $6	756,000.00
1,020 fender piles, at $13.50	13,770.00
3,698 cubic feet of fender wales, at 50 cents	1,849.00
2,400 cubic yards stone pitching in basin, at $2	4,800.00
Gates	114,934.40
Machinery	100,000.00
Buildings	30,000.00
Pumping	100,000.00
	1,248,395.90

Other Auxiliary Work.

Guard gate or movable dam in the Divide	300,000.00
Crib piers at lake entrance to canal	493,710.00
Three swinging bridges over canal	60,000.00
189,016 cubic yards embankment near site of locks, at 50 cents	94,508.00
19,080 cubic yards masonry walls at head of Lock No. 4, at $10	190,800.00
	1,139,018.00

Harbor of Brito.

5,658,898 cubic yards dredging, at 20 cents	$1,131,779.60
383,899 cubic yards stone in breakwaters (stone from Divide Cut), at $1.50	575,848.50
Lighting and buoying 1 second order lens in signal tower on promontory	10,000.00
One range light beacon, inner base of promontory	100.00
Two pier-head lights	2,000.00
One first class (middle channel) Nun buoy	200.00
Four third class (side channel) Nun buoys	200.00
	1,720,128.10
Right of way indemnity	100,000.00

RECAPITULATION, WESTERN DIVISION.

Section 1, canal	9,753,849.35
Diversion of the Rio Lajas into the lake	305,785.70
Railroads and telegraphs	459,000.00
La Flor dam	577,520.00
Locks Nos. 4 and 5	1,946,720.40
Tidal Lock No. 6	1,248,395.90
Other auxiliary works	1,139,018.00
Harbor of Brito	1,720,128.10
Right of way indemnity	100,000.00
Tipitapa Canal	275,000.00
	17,525,417.45

GRAND RECAPITULATION.

Eastern division	$23,686,048.30
San Francisco division	5,163,318.10
Lake and river division	5,692,556.70
Western division	17,525,417.45
	52,067,340.55
Surveys, hospitals, shops, management, and contingencies, 25 per cent	13,016,835.45
Grand total	65,084,176.00

Respectfully submitted.

A. G. MENOCAL,
Chief Engineer.

[NOTE.—Jan. 31, 1890. These estimates have been revised to conform to information obtained to date.]

APPENDIX H.

NICARAGUA CANAL CONSTRUCTION COMPANY.

REPORT OF THE BOARD OF CONSULTING ENGINEERS MAY 9, 1889.

To the Nicaragua Canal Construction Company:

GENTLEMEN: The undersigned were requested by your letter of January 10, 1889, to examine the plans and estimates prepared by your chief engineer, Mr. A. G. Menocal, for a ship canal between the two oceans at Nicaragua, and to indicate the cost, in their judgment, of constructing a canal along the line proposed and following, in general, the plans of your chief engineer. You also requested an opinion upon the practicability of the canal as now proposed, with due reference to the end in view, namely, the safe and convenient passage of sea-going ships from ocean to ocean. We beg to present the following report:

We have carefully examined the unusually full maps, profiles, borings, samples of materials, etc., which have been prepared and collected under the directions of your chief engineer, and the completeness and excellent form of which reflect credit upon your engineering staff.

We find certain elements of the designs submitted which may probably be advantageously modified. This would in some cases reduce and in others increase the quantities. It is also altogether likely that some parts of the work may be let at lower and other parts at higher prices than are estimated. We, however, are disposed to base our conclusions on quantities and prices which should prove sufficient to accomplish it upon the assumption of good and honest management, backed by an ample treasury. We have necessarily borne in mind the fact that the cost of the notable precursors of this canal project, both at Suez and Panama, has greatly exceeded the amount of the original estimates, and that this has been true of many other important works. While this might be, perhaps, in a large measure traced to unfortunate management, as well as the lack of such careful preliminary studies as have been laid before us in this case, we have nevertheless endeavored to guard against a similar result by a liberal allowance for every apparent contingency.

Acting on this principle, we have not yet deemed it wise to reduce the quantities or prices of your chief engineer's estimates in any instance, even when it appeared possible that this might prudently be done. His figures are, of course, founded upon a better knowledge of the local conditions than we can now possess. But to the extent to which it has appeared at all doubtful we have liberally increased one or both. Our conclusions are as follows:

The project, as a whole, appears to have comparatively few elements of doubt about it, as contrasted with other works of at all similar magnitude, and we consider it to be unquestionably feasible. The great area of Lake Nicaragua offers immunity from serious floods by regulating flow. Much of the earth excavation and dredging, the rock drilling, and the concrete mixing can be done by mechanical means, to that extent reducing the need for manual labor. The dams and embankments are proposed to be made largely from the immense mass of otherwise useless rock spoil. Under the climatic conditions, as we understand them, an adequate supply of labor should be obtainable. The project in detail consists of the following elements:

First. Of 10 miles on the east end and 0.57 miles on the west end of sea-level canal dredged in from the coast. The borings submitted seem to warrant the opinion that this will be entirely through alluvial deposits, as is also the case in certain parallel river diversions. The samples of material taken from these borings all appear favorable for dredging and the cost of such dredging can be foreseen with the greater precision, because less influenced by climate, weather, and rates of wages than most other engineering work.

Second. Of a flight of three locks on each end, all within a distance of about one and one-half miles at one end and two miles at the other, by which the ascent is made from the sea-level to the summit-level of 110 feet (this elevation being some four feet less on the eastern end to allow for a necessary fall of three-fourths of an inch per mile in the San Juan River). These locks are shown by the borings submitted to be all founded on rock. The proposed size for locks, 650 feet by 70 feet by 30 feet deep, seems sufficient for all demands.

Third. Of a very long summit level of 155.98 miles, consisting of four main parts:

(*a*) The great divide cuts of 3 and 8 miles in length, respectively, which are shown by the evidence submitted, to consist chiefly of rock, overlaid with a few feet of earth.

(*b*) The Deseado, San Francisco, Michado, and Tola basins formed by dams, furnish 21.57 miles of slack-water navigation, 18.13 miles of which require no excavation and the remaining 3.44 miles earth dredging only.

(*c*) The river San Juan, raised in level by a dam at Ochoa, so as to furnish slack-water navigation, and Lake Nicaragua furnish together 121 miles of free navigation of which 36.5 miles require some earth dredging and 3.83 miles some rock dredging.

(*d*) An inconsiderable amount (1.63 miles) of canal section in earth, chiefly to connect the San Francisco and Machado basins.

The two great rock cuts are by far the heaviest features of the work. In considering the plans for them and determining the proper amount and cost of work we have felt that every provision should be made to secure permanent slopes and to provide a section suitable for any vessels which can pass the locks. We think that the estimates, as modified by us, will secure these results.

The four great basins present a most admirable feature of the plans. As compared with a restricted canal channel, they facilitate navigation as well as reduce the cost. They are made, as is also the slack-water navigation of the San Juan River, by dams and embankments of considerable extent, none, however, of very great height. The plans submitted provide for forming these dams and embankments chiefly of heavy rock filling, the proximity of the great rock cuts (from which material must otherwise be wasted) to the sites of these dams and embankments facilitating their permanent construction at moderate cost. While we are not ready to say that the details of the plans submitted may not be, in some respects, modified, we regard the estimates adopted as sufficient to attain the results desired, subject to the following contingency:

There is the possible hazard in respect to the San Francisco and other basins, that they may not prove sufficiently retentive, owing either to leakage around the ends or under the bases of the dam and embankments, or to conceal permeable strata beneath the natural surface. We deem this a remote danger since both the surface and subterranean formations, so far as revealed by borings and by the reports of the observations of reliable men, familiar with the locality, are favorable.

For a work of ordinary magnitude we would accept such evidence as ample, but in view of the great area and volume of the basins, we agree that the possibility ought to be covered by the estimate. The probability is great that there are no permeable strata beneath the surface; if they exist they might not necessarily cause leakage, and even if leakage resulted, it would not necessarily do serious harm. Concentrated leakage if it occurred might possibly be remedied, and if it should develop at all would be likely to occur at an early stage of the work of construction. The worst result to be feared is that it might impel a modification of the original features of the project, enforcing a lowering of the water level at certain points, and at an additional cost of about $7,000,000. Under the circumstances, we, out of abundant caution, have deemed it wise and right to make the general contingency of allowance ($14,633,262) large enough, in our opinion, to cover this amount.

The requisite depth in the San Juan River and in Lake Nicaragua is obtained by a considerable amount of dredging, largely of earth but also with an amount of rock blasting under water, the precise extent and cost of which it is exceptionally difficult to foresee. We have therefore made an allowance for this work.

We have included in the estimates the sum of $1,035,000, for the diversion of the Rio Grande, as it seems proper to provide for the possible necessity of the diversion of this important stream from the canal. We have also included in the estimate the amount named by the chief engineer for the work that may be necessary in the valley of the San Carlos and in the construction of the canal between Lake Managua and Lake Nicaragua, this construction being a requirement of the concession.

The estimates for the harbor improvements at Brito and Greytown we leave unchanged. It appears probable that the amounts estimated may prove ample for all requirements other than gradual enlargement of basin areas, but whether so or not (and it is always extremely difficult to anticipate with certainty what may be the ultimate requirements for work of this class), we do not see the necessity in this work as we do in the canal proper for the endeavor to provide at the outset for all future demands of commerce. Sufficient expenditure prior to the opening of the canal to meet reasonable requirements for the first year or two after opening is all that we have taken into consideration in our estimates. The canal once opened adequate harbors can certainly be provided at a moderate percentage on the total cost of the canal, even should the sum herein estimated for harbors and contingencies prove insufficient. We must not be understood as implying by this statement, however, that we now see reason to fear that the present estimate for harbor work will probably prove inadequate. Such is not the fact.

It may not be regarded as improper to mention also that while the cuts, locks, dams, etc., should be completed for the full depths at the outset, something like one-fifth of the total amount of the estimate is for dredging and earth excavation under water, which is not required to afford 20 feet draught, and which can be completed with little or no disadvantage after the canal has been so far constructed as to pass vessels of that draught, making it possible—if found advisable—to open the canal for 20 feet draught for about four-fifths of the final cost.

Our estimate, which is intended to represent the maximum sum which the canal ought to cost, assuming, as aforesaid, integrity, good management, and no interruption of work from financial or other causes, is as follows:

Auxiliary railways, double track, standard gauge, from divide cut east to Greytown, and from divide cut west to Ochoa Dam, 20 miles, and telegraph, temporary and permanent systems		$1,110,000
Same on Pacific slope, Rio Lajas to Brito, 18 miles		459,000
		1,569,000
Harbor works, Greytown	$2,550,667	
Harbor works, Brito	1,720,128	
		4,270,795
Eastern division:		
Section 1, from Greytown to the divide		5,298,527
Section 2, the eastern divide		18,333,639
Locks Nos. 1, 2, and 3		4,195,828
Diversion of the Deseado and San Juanillo		982,016
San Francisco division		5,411,551
Lake and river division:		
Rio San Juan		3,685,701
Lake Nicaragua		2,211,825
Dam at Ochoa		726,137
Western division:		
From Lake Nicaragua to the Pacific		12,133,849
Diversion of Rio Lajas		346,786
La Flor dam		577,520
Locks 4, 5, and 6, and guard gates		3,899,116
Right of way indemnity		100,000
Auxiliary work—guard gates in divide, piers at lake, bridges, etc		1,139,018
Embankments and weirs in the valley of the San Carlos and canal between Lake Managua and Nicaragua		1,000,000
Diversion of the Rio Grande		1,035,000
For engineering, management, labor agencies, shops, police, sanitary service, and incidentals		6,250,000
		73,166,308
Add to cover specified and unspecified contingencies of construction, 20 per cent		14,633,262
Grand total of estimate		87,799,570

In conclusion, we think it proper to express our opinion that the exploration and studies of the region have been sufficient to warrant the conclusion that, unless hindered by obstacles or sinister influences such as would, if permitted to weigh, forbid the success of all ventures, this enterprise is full of promise.

Respectfully,

JOHN BOGART.
E. T. D. MYERS.
A. M. WELLINGTON.
H. A. HITCHCOCK.

I concur in the foregoing estimates as being in the aggregate ample for the purposes stated.

CHAS. T. HARVEY.

MAY 9, 1889.

APPENDIX I

CONCESSION AND DECREES OF THE REPUBLIC OF NICARAGUA TO THE NICARAGUA CANAL ASSOCIATION OF NEW YORK.

The President of the Republic to the inhabitants thereof:

Know ye that Congress has ordered as follows:

The senate and chamber of deputies of the Republic of Nicaragua do hereby decree—

ONLY ARTICLE.—The contract for a maritime interoceanic canal entered into the 23d of March, ult., between Dr. Adan Cárdenas, commissioned especially by the supreme government, and Mr. A. G. Menocal, member and representative of the Nicaragua Canal Association organized in New York, is hereby ratified. This contract shall be a law of the Republic if Mr. Menocal accepts it as soon as he be notified, with the following modifications and upon the following terms:

The undersigned, Adan Cárdenas, commissioner of the Government of the Republic, party of the first part, and Aniceto G. Menocal, representative of the Nicaragua Canal Association, party of the second part, both having sufficient powers, have entered into the following contract for the excavation of an interoceanic canal through the territory of Nicaragua:

ARTICLE I.

The Republic of Nicaragua grants the aforesaid Nicaragua Canal Association, and Mr. A. G. Menocal, representative of the said association, accepts on its behalf, for the purposes set forth in article 7, the exclusive privilege to excavate and operate a maritime canal across its territory, between the Atlantic and Pacific Oceans.

ARTICLE II.

The canal shall be of sufficient dimensions for the free and commodious passage of vessels of the same size as the large steamers used for ocean navigation in Europe and America, provided that no locks used in said work shall be less than five hundred and fifty (550) feet in length and thirty feet in depth.

ARTICLE III.

The State declares this work to be one of public utility.

ARTICLE IV.

The duration of the present privilege shall be for ninety-nine (99) years, to be counted from the day the canal shall be opened to universal traffic. During the aforesaid period the company shall have the right to construct and operate a railway along the whole extent of the canal, or those parts of the same that may be considered convenient for the better service and operation of the said work.

ARTICLE V.

The State binds itself not to make any subsequent concession for the opening of a canal between the two oceans during the term of the present concession, and also to abstain from granting a concession for a railroad, such as might compete with the canal for the transportation of merchandise, during the same period; but nothing in this article shall prevent the Government of Nicaragua from constructing or permitting the construction of such railways as it may deem advisable for commerce and internal traffic. Said Government also to have the right to construct or permit the construction of an interoceanic railway if in course of time it be demonstrated that the canal is not sufficient to satisfy the demands of the traffic of all nations.

The grantee company shall have the right to establish such telegraph lines as it may deem necessary for the construction, management, and operation of the canal. The Government shall have the right to occupy these lines for the public service without any remuneration to the company.

ARTICLE VI.

The Government of the Republic declares, during the term of this concession, the ports at each extremity of the canal, and the canal itself, from sea to sea to be neutral, and that consequently the transit through the canal in case of war between two powers or between one or more and Nicaragua shall not be interrupted for such cause; and that merchant vessels and individuals of all nations of the world may freely enter the ports and pass through the canal without molestation or detention.

In general, all vessels may pass through the canal freely, without distinction, exclusion, or preference of persons or nationality, provided they pay the dues and observe the regulations established by the grantee company for the use of the said canal and its dependencies. The transit of foreign troops and vessels of war will be subjected to the prescriptions relating to the same established by treaties between Nicaragua and other powers or by international law. But entrance to the canal will be rigorously prohibited to vessels of war of such powers as may be at war with Nicaragua or with any other of the Central American Republics.

Nicaragua will endeavor to obtain from the powers that are to guarantee the neutrality that in the treaties that shall be made for that purpose they shall agree also to guarantee a zone of land parallel to the canal and also a maritime zone in both oceans, the dimensions of which will be determined in such treaties.

ARTICLE VII.

This present agreement, with all its charges and advantages, shall be the object of a company of execution in agreement with Articles I, X, and those following thereafter.

Said company shall be the grantee, and whenever said name is used in this present contract, reference is made to it.

ARTICLE VIII.

The present concession is transferable only to such company of execution as shall be organized by the Nicaragua Canal Association, and in no case to Governments or to foreign public powers. Nor shall the company cede to any foreign Government any part of the lands granted to it by this contract; but it may make transfers to private parties under the same restriction.

The Republic of Nicaragua cannot transfer its rights or shares by selling them to any Government.

ARTICLE IX.

The people of all nations shall be invited to contribute the necessary capital to the enterprise, and it shall be sufficient for the fulfillment of this requirement to publish an advertisement for thirty (30) consecutive days in one of the principal daily papers of each of the cities New York, London, and Paris.

The capital stock of the final company shall be composed of shares, bonds, or obligations of any other kind, in such proportion as it may deem convenient. The issue and transfer of these obligations shall be exempt from stamp dues and from any other imposts or taxes established or that may be hereafter established in the Republic.

Of the capital with which the company shall organize, and which it proposes to distribute among the different countries interested in the enterprise, there shall be reserved at least five (5) per cent for the Central American Government and citizens that may desire to subscribe.

As soon as the company is ready to open subscription books it shall advise the Government of Nicaragua, which will invite the other Governments and through them private parties to subscribe. All such shares not taken within six months following the date on which the Government shall have been advised of that circumstance shall remain subject to the free disposition of the company.

ARTICLE X.

The company shall be organized in the manner and under the conditions generally adopted for such companies. Its principal office shall be in New York, or where it may be deemed most convenient, and it may have branch offices in the different countries of Europe and America, where it may consider it expedient.

Its name shall be the "Maritime Canal Company of Nicaragua," and its board of directors shall be composed of persons, one-half at least, of them shall be chosen from the promoters who may yet preserve their quality as such.

ARTICLE XI.

The Government of Nicaragua in its character of shareholder in the company of execution, as hereinafter provided, shall have the perpetual right of naming one director, who shall be an integral part of the board of directors of the company, with all the rights, privileges, and advantages conferred upon them by the statutes of the company and the laws of the country under which it shall organize.

The Government shall also have the right in its aforesaid capacity of shareholder to take part in such elections as the company may hold.

ARTICLE XII.

The company is bound to keep a representative in Nicaragua vested with all powers necessary for the proper conduct of the service and for the transaction of its business with the Government.

ARTICLE XIII.

The canal will follow the valley of the River San Juan to Lake Nicaragua, through which will be designated the most convenient route for communication with the Pacific Ocean. In any event the company shall have the most ample freedom to select the route which it considers most convenient between the two oceans for the excavation of the canal and its dependencies and its ports, particularly those serving for entrance and exit on both oceans. The company shall have the same liberty to adopt the route which may be deemed most advantageous and economical for the construction of the canal, after the final survey by a commission of competent engineers.

However, should the company, after the survey of the river San Juan, find it necessary to abandon, in any place, the bed of the river, and cut a lateral canal, the Government of Nicaragua reserves the right of requiring from the company the duty of establishing a communication between the part of the San Juan not used for canal purposes and the dividing level of the canal, by means of a lock, or a series of locks, suitable for the navigation of ships of six feet draft. As soon as the final plans are adopted and laid before the Government, it shall notify the company within one month after their receipt whether or not they meet with its approval, in order that the company may proceed in accordance therewith. It is understood that this duty does not in any manner compel the company to place or maintain in navigable condition for small craft the lower part of the river which these locks may be intended to place in communication with the canal.

ARTICLE XIV.

Within three years, to be counted from the commencement of the work upon the Interoceanic Canal, the company shall, at its own expense, construct a navigable canal between Lake Managua and the navigable part of the Tipitapa River, near Pasquier, of sufficient dimensions to admit of the free passage of vessels drawing six feet and of 150 feet in length. When completed this canal shall be taken possession by the Government of Nicaragua, and will be, after that date, the property of the Republic, which, by virtue of its ownership, shall be bound to bear all expenses required in the future for the service, maintenance, repair, and operation of the canal. But the company shall have the right to make use of it for all purposes useful for the maritime canal enterprise, and to pass through it freely with its vessels and those *belonging to* contractors employed in the service of the Interoceanic Canal during the term of this concession without being subject to any charge whatever, or to pay tolls or contributions of any kind to the Government of Nicaragua or to any person or company that may, through any cause, be in charge of the administration and operation of the work and its dependencies.

The Government of Nicaragua will place at the disposal of the company, free of all expenses and charges, all the lands that may be required, as well as the materials found thereon, or on those belonging to the Government and that may be utilized by the company in the execution of this work.

ARTICLE XV.

All expenditures for surveys, construction, maintenance, and operation of the Interoceanic Maritime Canal shall be borne by the concessionary company, without any subvention in money nor guaranty of interest on the part of the Republic, nor other concessions than those specified in the present agreement.

ARTICLE XVI.

The Company shall construct, at its expense, and maintain, in good condition, two large ports, one in the Atlantic and one in the Pacific, to serve as termini of the canal, each of them to have a lighthouse of the first order. It shall also construct at the two points on the borders of the lake, where the canal disembogues, two ports of lesser size, with the respective lighthouses.

The company is also obliged to maintain and improve said ports by means of dredges, dikes, piers, embankments, or any other works it may deem advisable, having always in view the good service of the traffic through the canal.

It may, for this purpose, select on the coasts of the two oceans, within the territory of Nicaragua, the localities which the surveys made indicate as preferable.

ARTICLE XVII.

All the space necessary, whether on the main land, in the lake, and its islands, at the ports, roadsteads, or rivers of the two oceans, for the establishment of the canal, its paths, and embankments, for depositing the materials from the excavations, and cuttings for the necessary spaces to be occupied by water after raising the dams which are to be constructed in the bed of the river, for all necessary deviations of streams, as well as for reservoirs, dikes, spaces about the locks, stations, lights and beacons, storehouses, buildings and workshops, deposits for materials, and also all those spaces necessary for the routes, service railways, and canals of the same nature for the transportation of the materials to the line of the work and for feeders for the canal; in short, all lands and places necessary to the construction and operation of the canal, as laid down in the drawings and plans made by the engineers of the company, shall be placed at the disposal of the company by the State, under the conditions set forth in the following articles.

ARTICLE XVIII.

Said lands belonging to the State will be given to the company without any compensation whatever; and, with regard to those belonging to private parties, the State charges itself with their expropriation if the company so requests. The compensation which may be required in this case shall be paid by the company.

ARTICLE XIX.

In all relating to the appropriation that may be made in conformity with the preceding article, the company shall enjoy all the immunities and privileges which the laws of the country accords to the State; so that in no case shall the company be obliged to pay more than the State would under similar circumstances.

ARTICLE XX.

The Government obliges itself to place the company, within six months after its request, in possession of up to one thousand (1,000) manzanas of land between the lake and the Pacific, at such places as the company shall designate, but they are to serve exclusively for cutting the canal, its havens, ports, and other accessory works. The Government shall on its own account cause the necessary expropriation to be made, and the company shall pay to it for all indemnity the sum of fifty thousand dollars ($50,000.00) American gold. This payment to be made by the company in Managua within four months after the date of its request.

ARTICLE XXI.

The company shall have the right to take, free of charge, from the public lands, for the purpose of construction, operation, and maintenance of the canal, whatever materials may be found on them, especially timber for construction and for fuel, the lime, stone, clay for bricks, and earth for fillings as may be necessary. As regards materials found on private lands, the company shall pay for what it may need thereof, enjoying in this respect the same rights and privileges which the State enjoys according to law.

ARTICLE XXII.

Should the company require to occupy, temporarily and during the construction of the canal, lands in the territory of Nicaragua which are not included in those designated in articles 17, 18, and 21, it shall not be obliged to pay any indemnity for them if they are public lands; and the state shall not have the right to sell or dispose of them in any other manner after the company has determined to occupy them, unless under the reservation of this right, whose limit shall be the completion of the works on the interoceanic canal. Should the lands belong to private parties the company shall enjoy, in regard to their temporary occupation, all the rights and privileges which the law accords to the state, with the special privilege of occupying them immediately after the declaration of necessity and utility, and after paying the compensation, which shall not exceed that which the state should be compelled to pay in a similar case.

ARTICLE XXIII.

The Republic of Nicaragua, desiring to assist the company efficaciously in the construction of the interoceanic canal, a work in which it takes the deepest interest, cedes in fee simple to the said company the public lands hereinafter mentioned in alternate lots with other similar ones which it reserves to itself, and of the dimensions and in the places as specified hereinafter:

1st. On the left bank of the river San Juan, from the Atlantic to Castillo Viejo, lots of three miles frontage on the canal and six miles in depth from the banks of the river. Where the canal diverges more than six miles from the banks of the river the lots are to be measured on both sides of it, and shall be three miles wide and six miles deep. And where this distance is less than six miles the lots shall be three miles front and three miles deep, and they shall be measured from the bank of the canal to the river, taking what may be lacking from the opposite bank of the canal.

2d. Three miles distance from Castillo up stream, on the right bank and up to the lake, lots of two miles in depth and two of frontage on the canal. From the lake along its south shore to the river Sapoá and thence to the river Lajas, lots of one mile frontage and one mile depth. On the left bank of the river from a point in front of Castillo and up to the lake, lots of three miles of frontage on the canal and four miles in depth.

3d. On the north shore of the lake, as far as the River Tule, lots of two miles frontage on the lake and two miles deep.

4th. In the places which the company selects in accordance with the government of the existing public lands, forty (40) lots, each four miles frontage by five miles deep, reserving always the acquired rights.

It is understood that the government reserves around each of the forts Castillo and San Carlos the lands included in a circle of one and one-half ($1\frac{1}{2}$) miles radius, whose center shall be the respective fortresses.

As a general rule, at the extremities of the interoceanic canal and at its points of contact with the lake, the opposite lots will be allotted one to the government and one to the company, but if this be not possible the first will belong to the government.

From the Atlantic to the lake that part of the river bed occupied by the canal shall be considered as part of the latter for all purposes of this article.

The measurement and setting out of all lands ceded by this contract shall be made at the expense of the grantees under the supervision of the Government.

The state shall vest in the company the possession of said lands so soon as the said company shall begin operations on the canal. Operations shall be regarded as begun when the provisions set forth in article 47 shall have been complied with. The final title deeds shall not be granted except as the work of the canal progresses and in due proportion.

ARTICLE XXIV.

In the unforeseen case that a new survey should show the necessity of adopting another line for the construction of the canal, which varies wholly or in part from the line set forth in article 13, the company shall have the right to the lands and other elements necessary for the construction of the canal, according to articles 16, 17, 18, 19, 21, and 22.

The company shall, in that event, also have the right to the lands mentioned in the preceding article, in the same proportions, conditions, and dimensions therein established, with the single proviso that if it alter the line the localities whence these lands shall be taken shall be altered accordingly.

ARTICLE XXV.

The state reserves the right to occupy, in the several lots of land granted the company, such places as it may need for such roads and public buildings as it may deem convenient. In the same manner it may use timber and other building materials found on such lands whenever they may be necessary for any work upon which it may determine. However, these lands with all their products, vegetable and mineral, shall be subject to the laws of the country so soon as they become the property of individual citizens by transfer from the company, and then, should the State need them for the ends set forth in this article, or for any others, it shall make compensation to their owners according to law, without any right on the part of the expropriated owners to reclaim against the company.

Should the company have improved the lands so taken for purposes of use, ornament, or pleasure the state shall be bound to reimburse it for such damages as it may have suffered, according to the assessment of experts.

ARTICLE XXVI.

Mines of coal, stone, gold, silver, iron, or other metals situated in the lands granted to the company shall belong to it by right, without need of previous "denounciation," it having the right to work them when considered expedient, subject to the laws of the country.

ARTICLE XXVII.

The company shall also have the right to utilize for its account, for sale or exportation, the lumber in the forests situated in the lands ced ed to it by the state from the time they enter into possession of them in accordance with this contract; that is, from the time of commencement of the works, always saving the acquired rights.

ARTICLE XXVIII.

From the day on which the present concession is ratified by Congress the public lands included in those necessary for the construction of the canal can not be sold, nor can any of those ceded to the company on the banks of the canal by article 23. Nor can they be leased to the prejudice of the company.

ARTICLE XXIX.

The company shall have the right, throughout the extent of the canal as well as at its mouths on both oceans, and in the lake and throughout the extent of the lands ceded by virtue of Articles 16, 17, 22, and 23, to enter upon the work of locating, leveling, excavating, dredging, and in general any other work of whatsoever nature that may be judged useful for the establishment and feeding of the canal, or for its operation, preservation, and maintenance. The company is specially authorized to execute along the canal line and on the banks of the River San Juan and its affluents, within the territory of Nicaragua, and also on the tributaries of Lake Nicaragua, the lakes or water courses which can be utilized in their flow to the Pacific, the system of dikes, rectifications, dredgings, embankments, dams, cuts, location of buoys, and in general all the works that in the opinions of the engineers of the company are deemed indispensable for the construction, feeding, navigation, and operation of the canal. The company may also do all works of like character deemed necessary at the entrances of the canal into Lake Nicaragua, as well as in the lake itself, in accordance with the route that may be determined upon in order to secure in it easy navigation, and as may be found necessary in the other lakes or lagoons that are to be traversed.

The embankments, fillings, and dikes formed in the mouths of the canal in the lake and in the ports on the oceans, by deposits of materials resulting from the excavations of the canal, shall belong in fee simple to the company; the Government having the right to use them if necessary, after compensation made. But it may never obstruct said ports nor widen the beaches in front of them, unless there is absolute necessity to do so, and in this case the embankments and fillings that it may be necessary to construct in front of the ports shall belong to the Republic.

In general the company shall have the right to use all the lakes and rivers of Nicaragua, the waters of which may be necessary, in the judgment of the engineers of the company, for the construction and supply of the canal and for maintaining its operations. It being understood that the damages caused to private parties by the deviation of the water courses shall be compensated for by the company according to a just assessment by experts in agreement with the laws of the Republic.

ARTICLE XXX.

The company shall not import merchandise into the territory of the Republic for the purpose of trafficking without paying the import duties established by law. But it may import free of custom duties, and of any tax whatsoever, the articles needed for the works of the enterprise, such as surveys, examination of localities, construction, use, operation, maintenance, repairs, and improvements of the canal; for the telegraphic service and for that of the railways; for running the workshops the company may keep in operation; and such articles may consist of tools, machinery, apparatus, coal, limestone of all classes, lime, iron, and other metals, raw or manufactured, mining powder, dynamite, or any other analogous substance. These articles may be transported between whatever points they may be required during the works of opening of the canal, and be discharged and stored free of all local taxes.

The company may import free of duties and taxes, during the work on the canal, provisions and medicines absolutely necessary for its own consumption. Goods, the commerce of which is not free, are excepted from the privileges contained in this article, which goods, excepting powder, dynamite, and other explosives, remain subject to the requisites and duties prescribed by the laws.

ARTICLE XXXI.

The vessels employed by the company as tugboats or for the service of the canal shall be free from all duties and also the materials for their repair and the fuel they use. The vessels and appurtenances from whatever place they may be coming for the use of the company shall also be exempt from all duties.

ARTICLE XXXII.

The Government will establish such regulations as it may judge necessary to prevent smuggling and to maintain public order in the region of the canal.

The company is bound to lend its assistance for the enforcement of such regulations. But in the free zone along the margin of the canal, as hereinafter provided, measures for the prevention of smuggling shall be limited to vigilance on the part of the employé or employés whom it may concern without any further measures being taken against passengers, vessels, or their cargoes, excepting when an attempt at smuggling is discovered; it being the intention of the State that there should be the most ample liberty of transit by the canal for persons and property, with the sole limitations established by this contract. Consequently the company shall have the right to discharge and reload ships in transit at such points as may be necessary in order to make repairs, lighten the vessel, shift cargo, or on account of any accident that renders it absolutely necessary, without being subject to search, exactions, or contributions of any kind, provided that in each case, and before beginning operations, the nearest customhouse authority shall be notified.

ARTICLE XXXIII.

The Government shall lend its protection, in conformity with the laws of the country, to the engineers, contractors, employées, and laborers engaged in the preliminary surveys or in the works of construction and operation of the canal.

ARTICLE XXXIV.

The company shall be exempt from all forced loans and military exactions in time of peace and of war. The foreign agents and employées shall likewise be exempt from direct contributions, forced loans, and military exactions during the time they are in the service of the canal, but they shall pay the taxes established by the laws if they acquire real property.

ARTICLE XXXV.

The company may freely introduce immigrants into the lands ceded to it, and the employés and workmen needed in its works and workshops. Asiatics, however, are excepted. Both the immigrants and the employés and workmen will be subject to the laws of the Republic and the regulations of the company. The Government assures them aid and protection and the enjoyment of their rights and guarantees in conformity with the constitution and the national laws during the time they remain on Nicaraguan territory.

ARTICLE XXXVI.

The Government of Nicaragua assures to the company and its agents under the laws of the country, as it does to the other inhabitants, the full enjoyment of the guarantees and rights which the constitution and the same laws grant to them. And reciprocally the company and its agents bind themselves strictly to respect the laws and regulations that are in force in Nicaragua, and especially to comply with the executory judgments of the tribunals without considering themselves vested with other rights than those which the laws concede in favor of the Nicaraguans.

ARTICLE XXXVII.

The Government shall establish all along the line of the canal included between the two terminal ports such police stations and revenue offices as in its judgment are necessary to preserve order in the region of the canal and for the observance of the fiscal laws of the Republic. All expenses incident to this service, including those of buildings, endowments, salaries and allowances of employées, and transportation of the forces, shall be paid to the Government by the company on such terms and conditions as may be established, taking into consideration the requirements and necessities of such service. The company, however, shall have the power to establish guards and watchmen for the service of the canal and the enforcement of its regulations.

ARTICLE XXXVIII.

Contracts for labor on the canal shall enjoy the privileges which the laws of the country accord to agricultural contracts, provided they be clothed with the formalities that the laws require in such contracts. And the contracts in regard to canal labor that the company execute in foreign countries shall be valid and lawful in Nicaragua during the term stipulated in them, provided they do not violate the laws of the Republic; provided also the documents containing them be presented to the proper authorities, with due authentication, that they may be registered.

ARTICLE XXXIX.

The company shall be exempt during the period of this concession, in peace and in war, from all manner of taxes upon the real property it may acquire by virtue of this contract, and from every kind of direct contributions, local taxes, or any other tax relating to the property and use of the canal, its buildings, and constructions appertaining thereto, in its entire length, including those that are situated in the ports and maritime establishments on the two oceans, as also the lands conceded to the company for the whole term of the privilege. This franchise is not assignable to those who buy the real estate which the company may dispose of by virtue of this concession.

ARTICLE XL.

The Republic of Nicaragua shall not establish any tonnage, anchorage, pilot, lighthouse dues or charges of any kind whatsoever upon vessels of whatever class, or upon the merchandise, baggage, and passengers which may pass through the canal from one ocean to the other, all such dues being reserved for the benefit of the company, as hereinafter set forth in article 43.

But all such merchandise as shall be loaded or discharged at any point of the canal intended for sale shall pay the import and export duties fixed by the revenue laws of the state.

ARTICLE XLI.

With the view of securing the most ample freedom in the transit of persons and property, and in order to remove as far as possible occasions for disagreeable questions, there shall be on each side of the canal a free zone, the extent of which shall be one hundred yards measured from the water's edge in the canal, it being understood that the borders of the lake shall not be considered as margin of the canal for the purposes of this stipulation.

All traffic declared illegal by the laws of the Republic shall be prohibited within the said zone, and the revenue authorities charged with watching and preventing smuggling shall act in conformity with the stipulations in article 32.

It is expressly agreed that every vessel that passes through the canal shall carry on board an officer named by the Government when the authorities think it necessary, and this employé shall act in conformity with the law in case he discovers its infringement.

The two ports to be constructed for the entrance and exit of the canal on the two oceans shall be declared free ports, and they shall be recognized as such from the beginning of the work to the termination of this concession.

The Government in agreement with the company shall establish, by special degree, the limits of the freedom of these ports, which limits shall not extend beyond the waters of the port, which are those included between the mouth of the canal and the entrance to the said ports.

ARTICLE XLII.

For the proper administration of the canal and its appurtenances, and in order to facilitate its construction and operation, the company shall establish the necessary regulations, which shall be binding on all persons found in its waters or its appurtenances, the sole reservation being that the rights and sovereignty of the State be respected.

It being understood that the company in the exercise of the powers conferred by this article may not make other regulations than those necessary for the administration and particular management of the canal, and that before executing and enforcing these regulations they shall be submitted to the Government for approval. The state will lend the aid of its authority for the enforcement of these regulations.

ARTICLE XLIII.

By way of compensation for the expenses of surveys, construction, maintenance, and operation of the canal, which under the present concession shall be at the cost of the company during the period of said privilege, it shall have the right to establish and collect for the passage of all kinds of vessels, travelers, and merchandise through the canal, and in the waters and ports pertaining to it, taxes on navigation, tonnage, and pilotage, towage, storage, lay days, anchorage, light, roadstead dues, wharfage, hospital dues, and any other similar charges in conformity with the tariff to be established by it in accordance with Article LII of this contract.

These tariffs may be modified by the company at any time on condition that all modifications that may be introduced shall previously be communicated to the Government, which, in case of finding them within the limits established by the said Article LII, shall cause them to be complied with as if they were regulations enacted by itself.

The payment of all the tariff dues shall be exacted without any exception or preference, and under identical conditions, from all vessels, whatever be the place they come from or their nationality, with the exception stipulated in the following article.

ARTICLE XLIV.

As compensation for the privileges and concessions that Nicaragua grants by this contract, it is hereby stipulated that the Republic shall enjoy the special privilege that Nicaraguan vessels sailing under the Nicaraguan flag may navigate the canal at a reduction of fifty (50 per cent.) per centum from the general tariff while engaged in the coasting trade or in the reciprocal trade with the other Republics of Central America. It is declared that the vessels referred to in the preceding paragraph must be exclusively of the register of the Republic, and they must not be owned, either in whole or in part, by citizens of other countries.

A reduction of fifty (50 per cent.) per cent. from the general tariff is also granted to vessels that begin their voyage for a foreign country in any of the ports belonging to the Republic, with a cargo wholly composed of products of the country. All the privileges to which this article refers shall be extended to the other Republics of Central America whenever Nicaragua shall find itself free from international obligations which may prevent it, or whenever one or more of the said Republics shall form a single nation with Nicaragua. The company can not collect any navigation dues whatever upon vessels and craft navigating the lake of Nicaragua and its prolongations without passing out of the locks. The Nicaraguan vessels of war, and in the case above provided those of the Republic of Central America, shall not pay any dues on passing through the canal.

ARTICLE XLV.

In case it may be possible to utilize the waters of the canal and its dependencies for the irrigation of plantations, gardens, and streets, or for the supply of towns that may be without it, or as motive power for private enterprises, the company shall have power to supply it, collecting dues in proportion to the amount furnished, according to the tariff that it may be establish in agreement with the Government.

ARTICLE XLVI.

In view of the existence of an exclusive privilege granted by the Republic in favor to Mr. F. Alf. Pellas, by a contract ratified on the 16th of March, 1877, for the navigation by steam on the lake and river for the purposes of the internal commerce of the Republic, the canal company shall have the right of expropriation against Mr. Pellas, as regards his rights and properties, on just assessments by experts, after making a corresponding compensation according to the laws of the Republic.

It is also stipulated that the company binds itself to pay to the Government of the Republic all it may from now on expend in any way for the improvement of the navigation of the river and the port of San Juan del Norte. This payment shall be made within six months of the date of the beginning of the works of the canal, and according to the original accounts of the corresponding office.

ARTICLE XLVII.

The company shall undertake at its expense the final surveys of the ground and the location of the line of the canal by a commission of competent engineers, two of whom shall be appointed by the Government of the Republic, which shall protect as far as it may the said commission.

There is granted to the concessionary company a term, not exceeding one year, in which to commence the final surveys for the canal, and one year and one-half additional for completing them; to organize the executing company, and commence the work of construction. Said terms shall begin to be counted from the date of the ratification of the present contract by the Nicaraguan Congress, published in the official paper, which shall be construed as notification. Furthermore, said terms are not to be extended, and it is understood that operations are not considered to have been begun if during the first year of the work two million dollars ($2,000,000) are not expended on it.

ARTICLE XLVIII.

A term of ten years is also granted to the company for the construction, completion, and opening of the canal for maritime navigation. However, should events of main force arise, duly justified and sufficient to impede the regular progress of the works during the period of the said ten years, an extension shall be granted equal in duration to the time that may have been lost by such delays.

If, at the expiration of the ten years aforesaid, the works should not be completed so as to have the maritime communication between the two oceans opened, in consideration of the great capital the company may have invested in the enterprise, and of the good will and ability it may have shown, and the difficulties encountered, the Republic binds itself to concede a new extension.

ARTICLE XLIX.

As a guaranty of the fulfillment of the obligations which the company incurs in accordance with Article 47, it shall deposit to the order of the Government of Nicaragua in a bank or in a mercantile house in the city of New York, which the Government may designate and within sixty (60) days from the date of the ratification of this contract, the sum of one hundred thousand ($100,000) dollars, American gold, which the company shall forfeit to the Republic if it do not fulfill the said obligations; and which sum otherwise shall be considered an advance to the Government on account of the necessary expenses of payment of the police of the canal according to the stipulations set forth in Article 37. This deposit, as soon as made, shall be at the disposal of the Government.

ARTICLE L.

In consideration of the valuable privileges, franchises, and concessions granted to the company by this contract, the Republic shall receive in shares, bonds, certificates or other securities which the company may issue to raise the corporate capital, six per centum of the total amount of the issue.

Such shares, bonds, certificates or other securities shall be free of all payment on the part of the Republic, being considered as paid in full. The six per centum shall in no event be less than four million dollars ($4,000,000), that is to say, forty thousand shares or obligations of whatsoever kind of one hundred ($100) dollars each.

Of said shares, bonds, certificates, or securities of whatsoever class, two-thirds shall not be transferable; but all shall participate in the benefits, interests, partitions, dividends, sinking funds, rights, privileges, and in all the advantages given to paid up shares without any distinction. The Government in its capacity of shareholder shall besides have the right to appoint one director who shall represent its interest in the board of directors of the canal company from the time of its definite establishment. The shares referred to in this article shall be delivered to the agent the Government may appoint to receive them and as soon as the company shall be ready to issue the certificates for its capital.

ARTICLE LI.

In order that the canal association may indemnify itself for the expenses it may have had to incur for the verifications, preparations, explorations, and surveys hereinbefore mentioned, and for all other expenditures that it will have to make until the definite organization of the company, it shall have the right from the time of the organization of said company to six per cent. in shares, bonds, certificates, or other securities which the company may issue for the purpose of raising the corporate capital, and which are to be issued in excess of the capital to be subscribed.

These bonds, shares, or securities shall be identically like the subscription shares, and issued from the same register or stock book. As a consequence they shall participate in all benefits, interests, partitions, dividends, sinking fund, rights, privileges, and of all the advantages given to the paid up shares, bonds, or securities without any distinction whatever.

ARTICLE LII.

From the receipts of the enterprise the company shall take in the first place the necessary amount to cover all the expenses for maintenance, operation, and administration; all the sums necessary to secure the interest which shall not exceed six per centum, and the amortization of the obligations and of the shares, and what remains shall form the net profits, of which at least eighty per centum (80 per cent.) shall be divided among the shareholders, it being agreed that after the lapse of ten years after the completion of the canal the company shall not divide among the shareholders in payment of dividends, directly or indirectly, by issue of shares or otherwise, more than fifteen per centum (15 per cent.) annually or in this proportion, from dues collected from the aforesaid canal and where it shall appear that these dues yield a greater profit, they shall be reduced to the fixed limit of fifteen per cent. per annum.

ARTICLE LIII.

The present concession shall be forfeited:

1st. Through the failure on the part of the company to comply with any of the conditions contained in Articles 8, 46, 47, 48, and 49.

2d. If the service of the canal, after its completion, be interrupted for six months, except in cases of main force.

When the concession shall have been declared forfeited, from whichever of these causes the public lands granted by this convention will revert to the Republic, in whatsoever state they may be, and without compensation even in the case that buildings may have been erected thereon.

Such lands shall be excepted as may have been alienated to private parties by the company, with the formalities prescribed by law, provided that such alienations shall not have taken place within the six months preceding the date on which the company may have become legally liable to the penalty herein established.

ARTICLE LIV.

On the expiration of the ninety-nine years stipulated in this concession, or in the event of the forfeiture contained in the preceding article, the Republic shall enter upon possession in perpetuity, of the canal, of works of art, lighthouses, storehouses, stations, deposits, stores, and all the establishments used in the administration of the canal, without being obliged to pay any indemnity to the company.

There shall be excepted from this condition, the vessels belonging to the company, its stores of coal and other materials, its mechanical work shops, its floating capital and reserve fund, as also the lands ceded to it by the State, excepting those in which are established the works indicated in the first part of this article, and which will revert to the State together with their immediate appurtenances, as necessary for the service of the canal, and as an integral part of the same.

But the company shall have the right, at the expiration of the aforesaid term of ninety-nine years, to the full enjoyment of the free use and control of the canal in the capacity of lessee, with all the privileges and advantages granted by the said concession, and for another term of ninety-nine years, on the condition of paying twenty-five per cent of the annual net profits of the enterprise to the Government of the Republic, besides the dividends due to it for its shares in the capital stock.

The company furthermore shall have the right to fix, at its discretion, the dues referred to in article 43 of this concession, so that the shareholders still receive dividends not to exceed ten per centum per annum on the whole capital after deducting the payment of twenty-five per cent of the net gains to the Government.

At the expiration of this second term of ninety-nine years the Government shall enter into perpetual possession of the canal and other properties referred to in the first part of this article, including also in this possession all that which is excluded in the said first part with the exception of the reserve and amortization funds. The failure to comply with any of the terms of the lease shall terminate it, and the State shall enter into possession of the canal and other works belonging to it in accordance with the provisions of the preceding paragraph.

ARTICLE LV.

Any misunderstanding that may arise between the State of Nicaragua and the company in regard to the interpretation of the present stipulations shall be submitted to a court of arbitrators composed of four members, two of which shall be appointed by the State and two by the company.

These arbitrators shall be designated by each of the parties within the period of four months from the day on which one of the contracting parties shall have informed the other in writing of the want of agreement on the point at issue. Should one of the parties allow the aforesaid term to pass, it shall be considered as assenting to the opinion or claim of the other.

The majority of the votes of the arbitrators shall decide finally and without recourse. In case of a tie vote the arbitrators shall select, by mutual consent, a fifth person, who shall decide. If unable to agree to such nomination, they shall draw by lot the names of the diplomatic representatives accredited to Nicaragua, and the first one drawn out shall exercise the functions of the fifth arbitrator; he shall either adopt the opinion of one or the other of the parties to the controversy, or render his opinion between these extremes, and his decision shall be final and without any appeal whatever; the fifth arbitrator failing, the second person drawn shall exercise these functions, and so on successively until a decision is reached.

Prior to the initiation of the works of opening the canal the Government shall formulate, with the concurrence of the company, rules to be observed by the arbitrators in all matters relating to procedure.

Questions between the company and individuals residing in Nicaragua shall be under the jurisdiction of the ordinary tribunals of Nicaragua, in conformity with the legislation of the country. In matters pertaining to nonresidents of Nicaragua the rules of international private law will be observed.

In witness of the foregoing stipulations, we have signed two instruments of the same tenor in Managua, on the 23d day of March, one thousand eight hundred and eighty-seven.

AD. CARDENAS.
A. G. MENOCAL.

The Government, finding the foregoing contract in conformity with the instructions transmitted, determines to approve it in all its parts and to submit it to Congress for its ratification.

Managua, April twelfth, one thousand eight hundred and eighty-seven.

E. CARAZO.

The acting subsecretary of the interior.

CANTON.

Done in the hall of sessions of the chamber of deputies, Managua, April 20, 1887.

TOMÁS ARMIJO.
LEOPOLDO M. MONTENEGRO.

LUIS E. SAENZ.

To the S. E. P., hall of the senate, Managua, April 23, 1887.

JOAQUIN ZAVALA.

S. MORÁLES.

ELIODORO RIVAS.

Therefore be it executed. Managua, April 24, 1887.

E. CARAZO.

The subsecretary of the interior in charge of the office:

ALEJANDRO CANTON.

Accepted on the same date.

CANTON.
A. G. MENOCAL.

I do hereby certify the preceding signature of the subsecretary of the interior, which reads Alejandro Canton, to be genuine.

Managua, April 25, 1887.

JOAQUIN ELIZONDO.

APPENDIX K.

CONCESSIONS AND DECREES OF THE REPUBLIC OF COSTA RICA TO THE NICARAGUA CANAL ASSOCIATION OF NEW YORK.

The Constitutional Congress of the Republic of Costa Rica, in the exercise of the powers granted to it by section 4, article 73, of the constitution, decrees—

ARTICLE FIRST.—The contract entered into on the 21st of July last between the honorable minister of public works, authorized for this purpose by the honorable President of the Republic, on behalf of the Government of the same, and Mr. Aniceto G. Menocal, on behalf of the Nicaragua Canal Association, for excavating and operating an interoceanic canal crossing, either in whole or in part, through the territory of the Republic, or running along the whole or part of its boundary with Nicaragua, is hereby approved.

The aforesaid contract with the modifications agreed to by Congress reads literally as follows:

The undersigned, Pedro Pérez Zeledón, secretary of the state bureau of public works, especially authorized by the honorable general, President of the Republic, to celebrate ad referendum the present contract, party of the first part, and Aniceto G. Menocal, representing the Nicaragua Canal Association, with full powers from it, and also authorized for this purpose by the executive committee of the said association, party of the second part, have revised the contract for the canal made in Washington on the 17th of last May, by the party hereto of the first part, in his capacity as envoy extraordinary and minister plenipotentiary of the Republic of Costa Rica to the Government of the United States of America, and Mr. Hiram Hitchcock, president of the aforesaid association; the said contract, with the modifications now agreed to by the undersigned, reads as follows:

ARTICLE I.

The Republic of Costa Rica grants to the Nicaragua Canal Association, its successors and assigns, the exclusive privilege to excavate and operate a maritime canal between the Atlantic and the Pacific Oceans, running either wholly or in part through the territory of the said Republic or along the whole or a part of her border line with the Republic of Nicaragua.

To render this contract fully efficient between the contracting parties hereto, it will be sufficient if the association aforesaid should use or occupy for the works of the said canal, or for any of its ports in one or the other oceans, any Costa Rican waters or at least waters in which Costa Rica has joint ownership or has rights of use and navigation.

Whenever the word "association" is used in this present document reference is made to the "Nicaragua Canal Association," its successors and assigns.

ARTICLE II.

The canal must be of sufficient dimensions for the free and commodious passage of vessels of the same size as the large steamers used for ocean navigation between Europe and America.

ARTICLE III.

The State leclares this work to be one of public utility.

ARTICLE IV.

The duration of the present privilege shall be for ninety-nine years, to be counted from the day on which the canal shall be opened to universal traffic.

During the aforesaid period the association shall have the right to construct and operate within the territory of Costa Rica a railroad along the whole extent of the said canal, or those parts of the same which it may consider convenient for the better service and operation of the said work.

The Republic binds itself not to make any subsequent concession for the opening of a canal between the two oceans as long as the present privilege lasts.

The Republic will also abstain during the same period from granting, within a zone of twenty-five miles along the canal, concessions for railroads from sea to sea that might compete with the canal in the traffic between foreign nations. This restriction shall not prevent the construction of new railroads that may be convenient for Costa Rica to build to the canal, or to any point on the northern frontier of the Republic, either connecting or not with any other railroads.

ARTICLE V.

The grantee association shall have the right to establish such telegraph lines as may be considered necessary for the construction, management, and operation of the canal.

The Government shall have the right to use the telegraph lines of the company from any station to any station that may be included within the line from sea to sea, without being obliged to pay the company for such service.

ARTICLE VI.

The Government of the Republic declares and accepts that the ports at each extremity of the canal and the canal itself from sea to sea during the time of this concession shall be neutral; and consequently in case of war between other nations, or between one or more nations and Costa Rica, the transit through the canal shall not be interrupted for such cause, and the merchant vessels and individuals of all nations of the world may freely enter the aforesaid ports, or pass through the canal without molestation or detention.

In general, all vessels shall freely pass through the canal without distinction, exclusion, or preference, whether of persons or nationalities, provided that they pay the dues and comply with the rules established by the association for the use of the said canal and its dependencies.

The transit of foreign troops and vessels of war shall be regulated by such provisions in regard thereto as are now or may be hereafter established in the treaties between Costa Rica and other powers, or by international law. But the entrance of the canal shall be strictly forbidden to vessels of war of any nation which may be at war with Costa Rica or with any other of the Republics of Central America.

Costa Rica shall endeavor to obtain from the powers that are to guarantee the neutrality that in the treaties to be made for that purpose they shall also bind themselves to guarantee the same conditions to a zone of land parallel to the canal and also to a maritime zone in both oceans, the dimensions of which shall be fixed by such treaties.

ARTICLE VII.

The present concession shall be transferable only to such company or companies as may be organized for the purpose of constructing or operating the canal, and in no case to foreign Governments or to foreign public powers.

Nor shall the association have the right to transfer to any foreign Government or public power any part of the lands granted to it by this contract. But it shall have the right to make such transfers to private parties under the same restrictions.

The Republic of Costa Rica shall not *transfer* its rights and privileges in respect to the canal to any foreign Government or public power.

The people of all nations shall be invited to contribute the necessary capital to the enterprise, and it shall be sufficient for the fulfillment of this requirement to publish an advertisement for twenty consecutive days in one of the principal daily papers of each of the cities New York, London, and Paris.

ARTICLE VIII.

The capital stock (*capital social*) of the final company which is to operate the cana shall consist of shares of the face value of one hundred dollars each, which shall be issued in such amounts as may be deemed necessary. The issue and transfer both of these shares and of all the bonds and obligations that the company may issue shall be exempt from stamp dues and from all other taxes or imposts now established or to be hereafter established in the Republic.

A five per centum, at least, of the capital stock with which the said company may be organized shall be reserved for such Central American Governments and citizens as may wish to subscribe.

As soon the said company is ready to open subscription books notice shall be given by it to the Governments of Costa Rica and Nicaragua, which shall invite the other Governments of Central America and through them private parties to subscribe.

The shares which, within six months, to be counted from the date of the notice given to the Government, of the opening of the subscription books, are not paid for shall remain at the free disposition of the company.

ARTICLE IX.

The company shall be organized in the manner and under the conditions generally adopted for such companies. Its principal office shall be either in the city of New York or in such place as may be deemed convenient.

Its first board of directors shall be composed of persons, one-half, at least, of whom shall be chosen from those members of the Nicaragua Canal Association who were promoters of the enterprise.

ARTICLE X.

The Government of Costa Rica, in its capacity of stockholder in the final company as hereinafter provided, shall have the perpetual right of appointing one director, who shall be an integral part of the board of directors of the said company, with all the rights, privileges and advantages conferred upon the other directors of said company, by the charter, by-laws, and statutes of the company and the laws of the country under which it shall organize.

The Government, in the said capacity of stockholder, shall also have the right to take part in the elections that the company may hold.

ARTICLE XI.

The said final company is bound to keep a representative in Costa Rica, vested with ample powers for everything that may be of interest to the company, either actively or passively.

ARTICLE XII.

The association shall have the most ample liberty to select and adopt the route which it may deem most convenient, advantageous and economical between the two oceans for the excavation, construction, and operation of the canal and its dependencies and ports, whether the same passes wholly or in part through the territory of Costa Rica or only along its border line.

Should the canal deviate from the river San Juan, in that section of the same in which Costa Rica has the right of navigation, the association binds itself to establish at such points as the engineers may deem proper, a communication between such parts of the San Juan River as may not be canalized and the dividing level of the canal, to the end of facilitating, without payment of any dues whatever, the navigation of Costa Rica vessels between the non-canalized part of the San Juan River and the canal, by means of a lock or series of locks suitable for the navigation of vessels of six feet draught.

It is understood that this obligation does not in any manner bind the association to place or to keep in navigable condition the lower part of the river which these locks may be intended to place in communication with the canal.

ARTICLE XIII.

All expenditures for surveys, construction, maintenance, and operation of the canal shall be borne by the association without any subvention in money or guaranty of interest on the part the Republic.

ARTICLE XIV.

The association shall construct, at its expense, and shall keep in good condition, two large ports, one on the Atlantic and one on the Pacific, at such points or localities as it may select within or without the territory of Costa Rica, to serve as termini of the canal; and each of them shall have a light-house of the first order.

ACTICLE XV.

All the area within the territory of Costa Rica, whether at the ports, roadsteads, or rivers of the two oceans, which may be necessary for the establishment of the canal, its paths, and embankments, or which may be occupied and covered by water after raising the dams which are to be constructed in the beds of the rivers, or for all necessary deviations to be made, as well as for reservoirs, dikes, spaces about the locks, stations, light-houses, and canals, store-houses, buildings, and workshops, deposits for materials, and also all those required for the routes, service railways, and canals of the same nature, for the transportation of materials to the line of the work, and for feeders of the canal; in short, all lands and places within the territory of Costa Rica necessary to the construction and operation of the canal, as may be laid down in the final drawings and plans made by the engineers of the association, shall be placed by the State at the disposal of the said association under the conditions set forth in the following articles.

ARTICLE XVI.

Such unappropriated lands as belong to the State shall be given to the association without any compensation whatever, and with regard to those lands belonging to private parties the state undertakes to condemn them should the association demand it.

The compensation which, in agreement with the laws of Costa Rica, may have to be paid in such cases, shall be paid by the association, and to it shall be added the amount of the expenses and costs of the respective actuations, in such a way that the national treasury shall suffer no loss.

ARTICLE XVII.

In all relating to the condemnation to be made under the provisions of the preceding articles the association shall enjoy all the immunities and privileges that the laws of the country grant to the state, so that the association may not be obliged to pay more than the state would under similar circumstances.

ARTICLE XVIII.

For the construction, maintenance, and operation of the canal the association shall have the right to take free of charge from the lands belonging to the State whatever material of a spontaneous production of the land that may be found on them, especially timber for construction and fuel, and limestone, clay for bricks, and earth for fillings that are to be made. As regards materials of the said class found on lands belonging to private parties, the association shall have the same rights and privileges granted by the laws to the State.

ARTICLE XIX.

If it should be necessary for the association to occupy temporarily and during the construction of the canal lands in the territory of Costa Rica which are not included in those designated in the Articles XV, XVI, and XVIII, it shall not be obliged to pay any compensation for them if they are unappropriated lands. And the state shall not have the right to sell or dispose of them in any other manner after the association has once determined to occupy them, unless under the reservation of this right, the limit of which shall be the execution of the works of the Inter-oceanic Canal. Should the said lands belong to private parties, then the association shall enjoy, so far as the temporary occupation thereof is concerned, all the rights and franchises which the laws grant to the State, with the special privilege of occupying them immediately after the declaration of utility and necessity and after payment of the proper compensation, which shall never exceed that which the state would be obliged to pay in a similar case.

ARTICLE XX.

The Republic of Costa Rica desiring to aid efficiently the association in this enterprise cedes in fee simple to the said association the public lands hereinafter mentioned, in alternate lots, with other similar ones which it reserves for itself, to wit:

1st. On the right or southern bank of the San Juan River, from a point three English miles below Castillo Viejo to the confluence of the San Carlos, should the canal follow the valley of the San Juan, lots fronting on the canal three English miles front by six deep.

2d. Between the San Carlos River and the Atlantic, should the canal pass wholly or in part through the territory of Costa Rica, or along the boundary of Costa Rica, lots of three English miles frontage on the canȧl and four deep.

3d. Should the route of the Selinas Bay be adopted, lots of two English miles frontage on the canal by two deep in the Costa Rican territory crossed by the canal or along which it may run, from the Pacific Ocean to a point two English miles distant from the mouth of the Sapoa River in the Lake of Nicaragua.

4th. Should the canal deviate from the San Juan River more than four miles towards the interior of Costa Rica, lots to be measured on both sides of the canal of two miles front and two deep. Should the deviation be less than four miles, then the lots of the northern bank of the canal shall have a front of two miles and extend in depth until they touch the San Juan River.

5th. From the Rio Frio to the Sapoa on the south coast of the Lake of Nicaragua, at two miles distant from the same and following the curve of its bank, lots of two English miles front by two deep.

6th. In the places where the company in accordance with the Government may select from the existing unappropriated public lands twenty-five lots, each two English miles in frontage by four deep. As a general rule, at the extremities of the Interoceanic Canal, should the same be within the territory of Costa Rica, the opposite lots will be allotted, one to the Government and one to the company; but, if this be not possible, the first will belong to the Government.

The state shall vest in the association the possession of said lands as soon as the location of the canal is finally determined and its construction begun by the association.

The rights required by private parties in the lands set forth in the preceding clauses are hereby reserved.

The measurement and setting out of all lands ceded by this contract shall be made at the expense of the grantee, with the intervention of the government.

The final title deeds shall be issued in due proportion as the work advances and not before.

Between the Atlantic and the point three miles below Castillo Viejo all parts of the San Juan and Colorado rivers occupied by the canal shall be considered, for the purposes of the present article, as a part of the said canal.

It is hereby understood that the whole of the lands transferred to the association by Costa Rica, in the different places and in the form as set forth in the foregoing article, shall not exceed in amount one-fourth of the total amount of lands granted to the company by the Government of Nicaragua, according to the contract made by it. Should they exceed such amount, the difference shall be deducted by reducing the number of lots mentioned in subdivision 5th of this article.

ARTICLE XXI.

The state reserves the right to occupy, in the several lots of land ceded to the Association, such space as may be needed for such roads and public buildings as it may deem convenient. In the same manner it shall have the right to use timber and other building materials which may be found on said land whenever they may be necessary for any work upon which it may determine. Should these lands become the property of private persons by virtue of a transfer made by the company, and the State should need them for the purpose set forth in this article, or for some other purposes, it shall pay their owners for them in conformity with the laws, and the expropriated parties shall have no right or claim against the association.

Should the association have made improvements on the lands referred to whether for the purposes of utility, ornament, or pleasure, the State shall be bound to compensate it for such damages as it may suffer according to appraisals of experts.

ARTICLE XXII.

Mines of coal, gold, silver, iron, or other metals, and stone quarries situated in the lands ceded to the association shall belong to it by right without the necessity of previous denunciation, and it shall have the right to work them whenever it may deem it convenient, subject to the laws of the Republic, but such lands as may be transferred by the association to private parties shall not enjoy this privilege.

ARTICLE XXIII.

The association shall also have the right to utilize for the works of the canal and its appurtenances the timber in the forests situated in the lands granted to it by the state from the very moment from which it enters into possession of the same under the present contract, the acquired rights always being reserved.

ARTICLE XXIV.

From the day in which the present concession shall be ratified by Congress, no alienation shall be made of any unappropriated lands necessary for the construction of the canal nor of those ceded to the association on the banks of the same. Nor shall the said lands be leased to the prejudice of the company. However, should the location of the canal not be definitely settled when this contract is ratified, the line of the canal shall for the purposes of this article be presumed to follow the northern boundary line of Costa Rica.

ARTICLE XXV.

The association shall have the right of doing throughout the whole extent of the canal within the territory of Costa Rica, at the mouths of the canal on the two oceans, and in the whole extent of the lands which under the present contract have been granted to it according to articles 15, 16, and 20, all such works as may be necessary for locating, leveling, excavating and dredging the canal, and all other works that may be required for the establishment, feeding, operation, preservation, and maintenance of the canal.

The association is especially authorized to make along the line of the canal and on the Costa Rican bank of the San Juan River and its Costa Rican affluents and confluents, as well as on the Costa Rican rivers tributary to the Lake of Nicaragua, the lakes or water courses which may be utilized in their flow to the Pacific or to the Atlantic; to construct dikes and dams; make rectifications, dredgings, embankments, and deviations; to locate buoys, and in general to do all the works that in the opinion of the engineers of the association may be deemed indispensible for the construction, feeding, navigation, and operation of the canal. The embankments, fillings, and dikes which may be made within the territory of Costa Rica at the mouths of the canal on the ports on the two oceans, by using materials resulting from the excavation of the canal, shall belong in fee simple to the association; but the Government shall have the right to occupy them in whole or in part after compensation made. Should any port of the canal be within the territory of Costa Rica, the association shall not obstruct such port nor widen its beaches unless there is absolute necessity to do so, and in this case the embankments and fillings that it may be necessary to construct in front of said port shall belong to the Republic.

In general the association shall have the right to use all the lakes and rivers of Costa Rica the waters of which may be necessary in the judgment of the engineers of the association to construct and feed the canal and to maintain its operations, but this right shall have the following restrictions, to wit:

1st. The navigation of the Costa Rican rivers, which the association may dam or otherwise use for the benefit of the canal, shall remain at the termination of the respective works in as good condition as it was before they were made.

2d. In the places where the waters of said rivers may overflow in consequence of the erection of dams or other artificial obstructions made by the association, the said association shall be obliged to do whatever may be practicable to prevent the formation of swamps and marshes.

3d. Such damages as may be caused to private parties in consequence of the deviation or elevation of the streams shall be compensated for by the association according to appraisals made by experts in conformity with the laws of the Republic, but the association shall not be obliged to pay more than the state would under similar circumstances.

ARTICLE XXVI.

The association can not inport merchandise into the territory of the Republic for the purposes of trafficking with it without paying the custom duties established by law, but it shall have the right to import free from custom duties and of any other imposts whatsoever the articles needed for the works of the enterprise, its surveys, explorations, examination of localities, constructions, use, operation, maintenance, repairs, and improvements of the canal, and also for the telegraphic and railroad service of the same, and for the works and workshops of the company, and the said articles may consist of implements, machinery, apparatus, coal, limestone of all classes, lime, iron, and other metals, whether raw or manufactured, mining powder, dynamite, or any other analogous substance. These articles may be transported between whatever points they may be needed during the work of the construction of the canal, and shall be landed and stored free from all local taxes.

The association shall also have the right to import free from duties or imposts, during the work of constructing the canal, such provisions, clothing for the workmen, and medicines as may be absolutely necessary for its own consumption.

Those articles the commerce of which is not free are excepted from the privileges granted in this article and shall remain subject, with the exception of gunpowder, dynamite, and other explosives, to such requisites and duties as are established by law.

ARTICLE XXVII.

The vessels that the association may employ as tug boats or for the service of the canal shall be free from all imposts or taxes of any kind whatever, and also the material to be used for their repair and the fuel that they may consume.

The vessels and their appurtenances, from whatever place they may come, for the service of the association shall be exempt from all duties and imposts.

ARTICLE XXIII.

The Government shall enact such regulations as it may deem necessary to prevent smuggling and for the preservation of public order in the region of the canal lying within the territory of Costa Rica or bordering on it and in the waters where it may exert joint jurisdiction. The company shall be bound to lend its assistance for the enforcement of such regulations. But in the free zone along the margin of the canal as hereinafter provided, measures for the prevention of smuggling shall be limited to vigilance on the part of the employé or employés whom it may concern, without right to any further measures, either against passengers, vessels, or their cargoes excepting when an attempt at smuggling may be discovered; it being the intention of the State that there shall be most ample freedom of transit through the canal for persons and property, with the sole limitations established by this contract. Consequently the association shall have the right to unload and reload ships in transit at such point as may be necessary in order to make repairs or lighten the vessels or shift their cargoes, or on account of any accident that unavoidably may render it necessary, without being subject thereby to search, exactions, or contributions of any kind, provided in each case, and before beginning operations, notice is given to the nearest custom house authority.

ARTICLE XXIX.

The Government shall afford its protection, in conformity with the laws of the Republic, to the engineers, contractors, employés, and laborers that may be engaged in the preliminary surveys or in the works of construction and operation of the canal.

ARTICLE XXX.

The association shall be exempt from all forced loans and military exactions whether in time of peace or of war. The foreign agents or employés shall also be exempt from direct taxes, forced loans, and military exactions during the time in which they are in the service of the canal, but they shall pay the direct taxes established by law in case they may become owners of real property or commercial or industrial establishments.

ARTICLE XXXI.

The association may freely introduce into the lands granted to it employés and laborers of every race who may be needed in its works and workshops; and it may also introduce immigrants of all nationalities, excepting Asiatics and negroes. Both the immigrants and the employés and laborers shall be subject to the laws of the Republic and to the regulations of the company. The Government assures them aid and protection and the enjoyment of their rights and guarantees in conformity with the constitution and the national laws during the time that they may remain within Costa Rican territory.

ARTICLE XXXII.

The Government of Costa Rica shall assure the association and its agents, under the laws of the Republic, as it does to the other inhabitants, the full enjoyment of the guarantees and rights which the constitution and laws grant to them. Reciprocally the association and its agents bind themselves strictly to respect the laws and regulations in force in Costa Rica, and especially to comply with the final decisions of the courts, without considering themselves vested with other rights than those granted by law to Costa Rican citizens.

ARTICLE XXXIII.

The Government shall establish all along the line of the canal which may be within the territory of Costa Rica or along its frontier or in the waters appertaining to it in ownership or joint jurisdiction, such police stations and revenue offices as in its judgment may be necessary for the preservation of order in the region of the canal and for the observance of the fiscal laws of the Republic.

The expenses incident to said services, including those of buildings, salaries, wages, and allowances of the employés and transportation of the forces, and which may be in excess of such as are now borne by the Government for the custom house actually established at the mouth of the San Carlos, or on any other point that may be crossed by the canal, shall be paid to the public treasury by the company on such terms and conditions as may be established hereafter, taking into consideration the requirements and necessities of such services.

The association shall also have the right to establish guards and watchmen for the service of the canal and the enforcement of its regulations.

ARTICLE XXXIV.

All contracts in regard to the works of the canal that the association may enter into in foreign countries shall be valid and effective, and shall have full force and effect in Costa Rica, provided they do not violate the laws of the Republic.

ARTICLE XXXV.

The association shall be exempt during the period of this concession both in time of peace and in time of war from all kinds of taxes upon the real estate that it may acquire by virtue of this contract and from all kinds of direct taxes, local charges, or any other imposts relating to the property and use of the canal, or of its buildings and the construction and dependencies thereof, all along its extent, including those situated in the ports and maritime establishments on the two oceans.

This franchise is not transferable to the purchasers of the real estate which the association may alienate under this grant.

ARTICLE XXXVI.

The Republic of Costa Rica shall not establish any tonnage, anchorage, pilot, or lighthouse dues or any other charges of any kind whatsoever, upon vessels of any class whatever or upon the merchandise, baggage, and passengers which may pass through the canal from one ocean to the other; all such dues are reserved for the benefit of the association as provided for in article 39.

ARTICLE XXXVII.

For the purpose of securing the most ample liberty of transit of persons and property a free zone shall be established on each side of the canal, and the width thereof shall be 90 meters and 288 millimeters, measured from the water's edge in the canal.

All traffic declared illegal by the laws of the Republic shall, however, be prohibited within the said zone and the revenue authorities whose duty it is to watch for and prevent smuggling shall act in conformity with the stipulations of Article XXVIII.

It is expressly agreed that every vessel that may pass through the part of the canal which way be within the territory of Costa Rica or along its borders or in waters over which it exerts co-jurisdiction shall carry on board an officer appointed by the Government whenever the authorities may deem it convenient, and that officer shall act in conformity with the law should he discover that it is being violated.

The two ports to be constructed for the entrance and exit of the canal on both oceans, which may be wholly or in part within the territory or in waters of Costa Rica, shall be declared free ports and shall be recognized as such from the opening of the *canal to the end of* this concession.

The Government, in agreement with the company, shall establish, by means of a special decree, the limits of this franchise, which shall never extend beyond the waters of the ports comprised between the mouth of the canal and the entrance of said ports.

All merchandise that shall be loaded or discharged at any point of the canal within the territory of Costa Rica, and intended for internal commerce, shall pay the import and export duties fixed by the revenue laws of the State.

ARTICLE XXXVIII.

For the proper administration of the canal and its dependencies, and in order to facilitate its construction and operation, the association shall establish the proper regulations, which shall be binding upon every person who may be found in its waters or in its dependencies; the sole reservation being that the rights and sovereignty of the State be respected.

It is understood that the association, in the exercise of the powers conferred by this article, shall not make other regulations than those necessary for the administration and particular management of the canal; and that, before carrying them into effect, they shall be submitted for the approval of the Government. The State shall lend the aid of its authority to enforce these regulations.

ARTICLE XXXIX.

By way of compensation for the expenses incurred in the surveys, construction, maintenance, and operation of the canal, or any part thereof, during the period of said privilege, the said association shall have the right to establish and collect, for the passage of all kinds of ships, vessels, travelers, and merchandise through the canal and in the waters and ports pertaining to it, such dues of navigation, tonnage, pilotage, towage, storage, lay days, anchorage, light, roadsteads, wharfage, hospital dues, and any other similar charges, in conformity with the tariffs to be established by it in accordance with article 45 of this contract.

These tariffs may be modified by the association at any time, on condition that all modifications that may be introduced in it shall be previously communicated to the Government, which, in case of finding them within the limits established by said article 45, shall cause them to be complied with as if they were regulations enacted by itself.

The payment of all the tariff dues shall be exacted without any exception or preference, and under identical conditions, from all vessels, whatever be the place they come from or their nationality, with the exception stipulated in the following article.

ARTICLE XL.

In compensation for the privileges and concessions that Costa Rica grants by this contract, it is hereby stipulated that the Republic shall enjoy the special privilege that Costa Rican vessels, navigating under the flag of Costa Rica, shall be entitled to navigate the canal at a reduction of fifty per centum of the general tariff while engaged in the coasting trade, or in the reciprocal trade with the other Republics of Central America.

To enjoy this privilege, the said vessels shall be necessarily of the register of the Republic, and belong to citizens of the same.

A reduction of fifty per centum of the general tariff is also granted to all vessels that begin their voyage for a foreign country at any of the ports belonging to the Republic with a cargo wholly consisting of products of the country.

Costa Rican vessels of war and revenue cutters shall pay no dues in passing through the canal. No dues shall be paid by the vessels of the National Register navigating either Costa Rican waters connected with the canal or the canal itself, without passing out of the locks, but said vessels are not in any way to obstruct the free navigation of the canal.

Costa Rica, on its part, shall not object to the enjoyment by Nicaraguan ships of the advantage granted in this article to those of Costa Rica, provided that Nicaragua, on its part, consents that the ships of Costa Rica shall enjoy in Nicaraguan waters the said privilege.

All the concessions to which this article refers shall be extended to the other Republics of Central America, or any of them, whenever Costa Rica and Nicaragua shall find themselves free from international obligations which may prevent it, or whenever one or more of said Republics shall form a single nation with Costa Rica.

ARTICLE XLI.

In case it may be possible to utilize the waters of the canal and its dependencies for the irrigation of plantations, gardens, and streets, or for the supply of towns that may be without it, or as motive power for private enterprises, the company shall have the power to supply it, collecting dues in proportion to the amount furnished, according to the tariff that it may establish in agreement with the Government.

ARTICLE XLII.

The association shall undertake at its expense the final surveys of the ground and the location of the line of the canal by a commission of competent engineers. The Government of Costa Rica shall have the right of visiting and inspecting the final surveys which are in progress, and those already completed by an engineer appointed by said Government, and whose salary shall be paid by the association, the amount thereof to be fixed hereafter by special agreement between the Government and the company.

A period of two years and a half, to be counted from the date of the ratification of this contract, is granted the association for the final surveys of the canal, and within the said time the association shall have to make the said final surveys, organize the company which is to carry on the work, and begin the work of construction.

The work of construction shall be understood to have commenced if within three years after its inception two millions of dollars have been expended on it.

The period herein provided for shall admit of extension by the Republic at the request of the association and upon grounds of justice, in the judgment of the Government.

ARTICLE XLIII.

A term of ten years is also granted to the association for the construction completion, and opening to traffic the canal for maritime navigation. However, should events of main force arise, duly justified and sufficient to impede the regular progress of the works during the period of the said ten years, an extension shall be granted equal in duration to the time that may have been lost by such delays.

If at the expiration of the ten years aforesaid the works should not be completed so as to have the maritime communication between the two oceans opened, in consideration of the great capital the company may have invested in the enterprise and the good will and ability it may have shown and the difficulties encountered, the Republic binds itself to grant a new extension.

ARTICLE XLIV.

As a guaranty of the fulfillment of the obligations which the final company which is to construct the canal incurs in accordance with article 42, it shall deposit to the order of the Government of Costa Rica, in a bank or in a mercantile house in this city, or with an agent which the Government may designate, immediately after the certificates are issued, one thousand shares of its capital stock of the nominal value of $100 each. The said one thousand shares of capital stock shall be considered an advance to the Government of the payment of the police and revenue expenses to be made under article 33, and the association shall be credited with the actual value of said shares at the time such payments are made.

ARTICLE XLV.

In consideration of the valuable privileges, franchises, and concessions granted by virtue of this contract to the association, the Republic shall receive in shares, certificates, or other values representing the capital stock of the final company, an amount equal to one and one-half per centum of the total amount of the issue of said capital stock, in shares or certificates of $100 each. This sum shall in no event be less than $1,500,000. Said shares shall be considered as fully paid up, and two-thirds thereof shall not be transferable. All these shares shall participate in the benefits, interests, distributions, dividends, amortizations, rights, privileges, and all other advantages granted to paid-up shares, without any difference whatever. These shares, together with the other privileges herein granted by the association to the Government, shall be in full compensation to the Republic for all public unappropriated lands that may be flooded and for all the privileges and concessions conferred by this contract, and shall cover completely all claims of this description on the part of the state against the association or the final company. The shares to which this article refers shall be delivered to the agent appointed by the Government for this purpose as soon as the company may be ready to issue certificates of its capital.

ARTICLE XLVI.

From the earnings of the enterprise the company shall take, in the first place, the necessary amount to cover all the expenses for maintenance, operation, and administration; all the sums necessary to secure the interest, which shall not exceed six per centum, and the amortization of the obligations and of the shares, and what remains shall form the net profits, of which at least eighty per centum (80 per cent.) shall be divided among the shareholders, it being understood that after the lapse of ten years after the completion of the canal, the company shall in no case divide among its shareholders in payment of dividends, directly or indirectly, by issue of shares or otherwise, more than fifteen per centum (15 per cent.) annually or in this proportion, from dues collected from the aforesaid canal; and where it shall appear that these dues yield a greater profit, they shall be reduced to the fixed limit of fifteen per cent. per annum.

ARTICLE XLVII.

The present concession shall be forfeited:

1st. Through the failure on the part of the Company to comply with any one of the conditions contained in Articles VII, XLII, and XLIII.

2d. If the service of the canal, after it is completed, is interrupted for six months, unless in case of unforeseen accidents or main force.

When the concession shall have been declared forfeited from whichever of these causes, the public lands granted by virtue of the present contract shall revert to the Republic in whatever condition they may be, and without compensation, such lands as may have been alienated by the Company with the formalities prescribed by law, shall be excepted, provided that such alienations shall not have taken place within the six months preceding the date on which the company may have become legally liable to the penalty herein established.

ARTICLE XLVIII.

At the expiration of the ninety-nine years stipulated in this concession, or in the event of the forfeiture expressed in the preceding article, the Republic shall enter into the possession in perpetuity of that part of the canal, its warehouses, stations and other establishments used for the management thereof that may be found within the national territory. Such works as may be found in waters in which the Republic has joint sovereignty shall belong to her in joint ownership. And in regard to such parts of the canal or of the waters thereof in which Costa Rica has not the eminent domain, but simply the right of use and free navigation, the Republic, at the expiration of the ninety-nine years, or in the cases of forfeiture above named, shall retain in perpetuity the said rights of use and free navigation. The Republic shall not be obliged to pay to the company any compensation for the same.

There shall be excepted from this condition the vessels belonging to the company, its stores of coal and other materials, its mechanical workshops, its floating capital and reserve fund, and at the expiration of the said ninety-nine years also the lands ceded to it by the state under the present contract, excepting those in which the works indicated in the first part of this article may be found established, which will become the property of the state, with their immediate dependencies as necessary for the service of the canal and an integral part of the same.

But the company shall have the right, at the expiration of the aforesaid term of ninety-nine years, to the full enjoyment and a free use and control of the canal and such parts thereof as may be within the territory of Costa Rica, with all the privileges and advantages granted by this concession in the capacity of lessee for a second period of ninety-nine years, upon payment to the Government of Costa Rica of six and one-quarter per centum of the annual net profits of the enterprise, besides the dividends due to it for its share in the capital stock.

The company shall have the right to fix at its discretion the dues referred to in article 39 of this concession, so that the shareholders, after the payment of 31¼ per cent is deducted, shall still receive dividends of ten per cent per annum on the whole capital.

At the expiration of this second period of ninety-nine years the Government shall enter into perpetual possession of the canal and the other property referred to in the first part of this article; and this delivery shall also embrace everything excluded in the said first part, except the lands ceded to the association by this contract and the reserve and sinking fund.

The failure to comply with any of the conditions of the lease shall terminate it, and the state shall enter into the possession of the part of the canal which corresponds to it, owing to it being situated in Costa Rican territory or in the places in which Costa Rica is joint owner, and also of the other works which belong to the canal, in accordance with the provisions of the preceding paragraph.

ARTICLE XLIX.

Any misunderstanding that may arise between the Republic and the company in regard to the interpretation of the present stipulations shall be submitted to a court of arbitrators, composed of four members, two of whom shall be appointed by the state and two by the company.

These arbitrators shall be designated by each party within the period of four months from the day on which one of them shall give notice to the other in writing of the want of agreement on the point at issue. Should one of the parties allow this period to lapse it shall be considered as assenting to the opinion or claim of the other.

The majority of the votes of the arbitrators shall finally decide without recourse. In case of a tie vote the arbitrators shall appoint, by mutual consent, a fifth person, who shall decide, and in case of their default the respective parties will appoint him. If they cannot agree to such appointment they shall draw by lot the names of the diplomatic representatives accredited to Costa Rica, and the first one drawn out shall exercise the functions of the fifth arbitrator. He shall concur on one of the two opinions, and what may be so decided shall be final and without recourse of any kind. If the fifth arbitrator should fail, the second person drawn shall exercise these functions, and so on successively until the decision is reached.

Prior to the initiation of the works of opening the canal the Government, in concurrence with the company, shall formulate a set of rules to be observed by the arbitrators in all matters relating to procedure.

All questions between the association and private parties residing in Costa Rica shall be determined by the ordinary courts of Costa Rica in conformity with the legislation of the Republic. In matters pertaining to parties not residing in Costa Rica the rules of private international law shall be observed.

ARTICLE L.

This contract, after being approved by the Hon. General President of the Republic, shall be submitted to the supreme legislative power for the purpose that if they deem it convenient they should impart to it the necessary ratification, and in case such approval is not obtained, the Nicaragua Canal Association will be released from all the obligations to which it is bound by it. Such ratification or non-ratification shall be made within one hundred and twenty days from this date.

In witness whereof the undersigned have set their hands to four copies of the present contract, two for each party, in San José de Costa Rica, 31st July, 1888.

PEDRO PEREZ ZELEDÓN.
A. G. MENOCAL.

PALACE OF THE PRESIDENT,
San José, July 31, 1888.

In consideration that the foregoing contract agrees with the instructions given for its celebration to the honorable secretary of state, who authorizes it, it is hereby approved in all its parts for the purpose that it may be submitted to the deliberation of the Constitutional Congress.

Countersigned by his honor the President of the Republic.

PEREZ ZELEDÓN.

ARTICLE 2.—The contract to which the foregoing article refers is hereby exempted from the payment of stamp duties.

To the executive power:

Given in the hall of sessions of the national palace in San José, on the 9th day of August, 1888.

A. ESQUIVEL,
President.

MANUEL J. JIMÉNEZ,
Secretary.

FÉLIX GONZÁLEZ,
Vice Secretary.

PRESIDENTIAL PALACE,
San José August 9, 1888.

Therefore be it executed.

BERNARDO SOTO.

The secretary of state of the department of public works:

MAXIMO FERNANDEZ.

APPENDIX L.

REPORT ON THE TONNAGE OF TRAFFIC WITHIN THE ZONE OF ATTRACTION OF THE MARITIME CANAL OF NICARAGUA, IN 1890, *AND AS ESTIMATED FOR* 1897.

[By THOS. B. ATKINS, Secretary and Treasurer of the Maritime Canal Company of Nicaragua.]

THE MARITIME CANAL OF NICARAGUA.

REPORT ON THE TONNAGE OF TRAFFIC.

The question of the amount of traffic which will be attracted to any interoceanic canal across the American Isthmus is one concerning which there has been, and probably will continue to be, a wide difference of opinion.

The problem is unquestionably an intricate one. It is difficult to determine the relative value of the factors of which it is composed; and it is made more complex by the elements of futurity which enters into it.

The most serious attempt at its solution was made for the information of the International Congress, which assembled at Paris in 1879 to consider the various projects at that time before the public for an interoceanic canal across the Isthmus and the questions pertinent thereto. The question was then made the subject of careful investigation and study by a statistical commission composed of eminent scientists, statisticians and officials, of which M. Levasseur, member of the "Institute National" of France, was chairman.

"Lev." In the report at the time presented by M. Levasseur it was estimated upon premises set forth at some length, and which further on shall have more particular consideration, that the tonnage of traffic existing in 1876, within the zone of attraction of such a canal, upon the basis of an estimated average value per ton, was 5,268,000 tons.

Upon a statistical basis, partly furnished by Rear-Admiral Ammen, U. S. Navy, and Mr. Eli Lazard, of San Francisco, it was also estimated at 4,833,000 tons.

Both estimates being duly considered, 5,250,000 tons was finally accepted by the commission as a "very moderate" estimate of the tonnage existing in 1878 within the zone of attraction.

"Lev." In arriving at this conclusion the commission justly remarked: "Whatever may be the latitude at which the American Isthmus may be pierced between Lake Nicaragua and the Atrato, under whatever technical conditions the anal may be constructed, the commerce of the two oceans, considered as a whole will profit equally by it."

From these results thus arrived at it was argued in the report that the natural growth of commerce would, in ten years' time, say by 1888, increase the total of tributary tonnage from the 5,250,000 tons, recognized as existing in 1878, to 7,250,000 tons, from which the canal, at the time of its expected completion, would be able to draw for its revenue.

At the time when the report was prepared and submitted the statistics of international commerce were neither as abundant nor as accessible as they are at the present time; even now they are not by any means as complete as is desirable for an exact examination of the question. South American returns of tonnage are particularly misleading; oftentimes the same vessel is registered in more than one port of the same country, and thus is made to count twice or more times in the tonnage reports of registered entries and clearances. The only traffic data of those countries of reliability, are the values of exports and imports, which, from the channel through which they are collected—customs returns—are not apt, at all events, to be exaggerated.

In making a new estimate it is, therefore, not only expedient but almost imperative to follow the method adopted by M. Levasseur and his eminent associates in their work, and in doing so it is somewhat remarkable how fully the growth of commerce has verified their anticipations. This estimate of a time so long passed is chiefly valuable for comparison as indicating what growth of commerce may be anticipated in the lapse of time required for construction of the Nicaragua Canal, and it is of some importance in that respect to ascertain as nearly as possible the correctness of the premises with which comparison is to be made.

Accepting the report of the commission as a fair estimate of tributary commerce existing in 1878, we have 5,250,000 tons as a basis for comparison.

In an estimate furnished the United States Treasury Department in 1880 it is claimed that the meridian of 110° east from Greenwich will be the dividing line beyond which the attraction of the canal will cease to be influential. We are not prepared to admit this, for the reason that ocean currents and prevailing winds and more favorable climate will at least influence much of the trade of Europe to circumnavigate the globe by way of the Nicaragua Canal, when it is opened, as a return route rather than to use the Suez Canal both going and returning; and thus the attraction of the canal will be felt to a greater or less extent even by the enormous trade of Europe, or, more exactly speaking, of England with India. This principle seems to have been accepted by the statistical commission. Adopting for the purpose of an estimate the dividing line suggested, the meridian of 110° east from Greenwich, the commerce of the world which would have been directly subject to the attraction of the canal in 1888, had it then existed, is largely shown in the following table, carefully compiled from official returns.

It is proper to premise (1) That, as previously stated, the most reliable statistics of commerce are given in values and not in bulk or weight; where it is otherwise, the fact is noted. (2) That wherever local statistics are accessible they are accepted as the more reliable; in other cases the figures of the British Board of Trade are accepted. (3) That as returns are made in different currencies they are roundly converted into dollars at $5 for the pound sterling, 20 cents for francs, 40 cents for guilders, 75 cents for pesos, $1.15 for Haikwan taels, 25 cents for marks, $1 for the yen of account, 20 cents for pesetas. These figures do not vary materially from actual values, and are very much more convenient for computation. (4) In the instance where returns are made in bulk they are reduced to tons at the round allowance of 1,000 grams to the ton.

TABLE OF COMMERCE SUBJECT TO THE ATTRACTION OF THE CANAL.

[To be divided into three classes: Class 1, entirely tributary; class 2, largely tributary; class 3, partially tributary.]

Commerce of the places named, exports and imports.

Reference.	Class.	Countries.	Amount.
		With Great Britain:	
S. Y. B., 111	2	Hong-Kong, 114° east from Greenwich	$20,508,000
S. Y. B., 235	2	New South Wales	83,932,800
S. Y. B., 261	2	Queensland	23,655,480
S. Y. B., 268	2	South Australia	24,998,480
S. Y. B., 286	2	Victoria	73,606,350
S. Y. B., 292	2	Western Australia	3,380,850
S. Y. B., 296	2	New Zealand	44,564,000
S. Y. B., 275	2	Tasmania	3,608,010
S. Y. B., 776	3	Java	22,358,760
S. Y. B., 944	2	Philippine Islands	14,394,690
S. Y. B., 416	2	China	54,157,657
S. Y. B., 715	2	Japan	37,403,580
S. Y. B., 452	1	Ecuador	2,489,910
S. Y. B., 809	1	Peru	15,245,870
S. Y. B., 387	1	Bolivia	1,267,830
S. Y. B., 406	2	Chili	62,437,161
S. Y. B., 78	2	Central America	10,412,250
		With France:	
S. Y. B., 515	2	New Caledonia	1,565,812
S. Y. B., 715	2	Japan	17,761,441
S. Y. B., 406	2	Chili	7,857,430
		With Germany:	
S. Y. B., 546	2	Australia	8,129,000
S. Y. B., 715	2	Japan	6,878,462
S. Y. B., 406	2	Chili	14,098,930
S. Y. B., 577	2	Hamburg with Australia	(*)
S. Y. B., 416	3	China with Germany, France, etc	18,283,315
S. Y. B., 944	3	Spain with Philippine Islands	4,123,000
S. Y. B., 379	1	Belgium with Peru	6,440,995
S. Y. B., 762	3	Netherlands with Dutch East Indies	66,080,000
		With United States (Atlantic ports, chiefly New York; Pacific ports, chiefly San Francisco):	
C. & N., 40	2	British East Indies, Atlantic ports	22,765,825
C. & N., 49	3	British East Indies, Pacific ports	1,432,041
C. & N., 39	2	French East Indies, Atlantic ports	319,427
C. & N., 40	2	Dutch East Indies, Atlantic ports	7,042,412
C. & N., 40	1	Hong-Kong, Atlantic ports	2,113,021
C. & N., 41	3	Hong-Kong, Pacific ports	3,050,556
C. & N., 39	1	China, Atlantic ports	12,484,834
C. & N., 39	3	China, Pacific ports	6,932,940
C. & N., 42	1	Japan, Atlantic ports	10,038,673
C. & N., 43	3	Japan, Pacific ports	9,380,330
C. & N., 40	1	British Australia, Atlantic ports	13,279,825
C. & N., 41	3	British Australia, Pacific ports	5,040,316
C. & N., 42	1	Philippine Islands, Atlantic ports	8,719,069

Commerce of places named, exports and imports—Continued.

Reference.	Class.	Countries.	Amount.
		With United States (Atlantic ports, chiefly New York; Pacific ports, chiefly San Francisco)—Continued.	
C. & N., 43	3	Philippine Islands, Pacific ports	$2, 053, 660
C. & N., 42	1	Hawaii, Atlantic ports	197, 619
C. & N., 43	3	Hawaii, Pacific ports	16, 025, 780
C. & N., 32	1	Chili	4, 814, 625
C. & N., 34	1	Ecuador	1, 331, 370
C. & N., 36	1	Peru	1, 024, 497
C. & N., 22 and 24	2	Central America (Nicaragua, Costa Rica, and Salvador)	5, 170, 980
		Pacific ports of the United States with—	
C. & N., 5	1	Belgium	837, 840
C. & N., 7	1	France	5, 632, 359
C. & N., 7	1	Germany	1, 136, 506
C. & N., 6–10	1	Great Britain	33, 944, 476
C. & N., 30	1	Cuba	535, 111
C. & N., 33	1	Brazil	166, 012
		Total	825, 110, 167

* Value, not reported; weight, 65,300,000 kilos, say about 65,300 tons.

C. & N., 45. In the table the trade of Asia, etc., with interior ports of entry of the United States, which is chiefly transshipped at San Francisco, is omitted because it is almost entirely in high-priced commodities which yields only a low tonnage. It amounts to $2,305,138.

To this large aggregate there should be added the commerce of the Atlantic and Pacific coasts of the American continent, each with the other, and any other trade of the Pacific coast not already included. Some portion of the trade referred to now finds its way around Cape Horn, a part goes by the way of the Panama Railroad across the Isthmus, and a considerable portion of it helps to make up the tonnage of the Pacific railroads. A large part of the Pacific railroad portion is included in the items of commerce between China, Japan and Australia, and the United States, particularly that part of such commerce as is entered via San Francisco.

In addition to this there is a large traffic between our Atlantic and Pacific seaboard already established and likely to increase with such strides as is known to trade and commerce in the Western hemisphere only as soon as an advantageous waterway is offered for its transportation. It is now limited by the high cost of railroad transportation or the length of the ocean voyage. The rate for transportation between New York and San Francisco by rail in carload lots is not less than $20 per ton on low class freight and much higher on general merchandise. By sailing vessels freights are rarely over $10, and more often $8 or $9. The difference in time of transit by existing routes is that between one hundred and twenty days for a voyage around Cape Horn and fifteen to eighteen days for fast freight by rail across the continent.

From Hong-Kong to New York, around the Cape, is about one hundred and sixty-five to one hundred and seventy days by sailing vessel; by steamer across the Pacific and rail across the continent it is thirty-eight to forty days; by the canal route it would be one hundred days by sail and thirty-eight to forty days by steamer. Under certain conditions commerce pays the difference in cost to save the difference in time between the quicker and the slower route, for by so doing capital is turned over and made to yield its profit more frequently, the risks of unforeseen contingencies are reduced to a minimum, and the accidents which bring disaster to the merchant are, to an equal extent, avoided. High-priced commodities, such as come to us from Asia and the islands of the Pacific, will bear the additional charge in consideration of the saving of time, but lumber and other low-priced material can not. Recently the bark *W. W. Crapo* brought from Port Townsend, Wash., a cargo of shingles and spars to Boston, Mass. The *Crapo* is a 1,650-ton bark, and could be run at a cost of, say, $75* per day, not including port charges. She occupied one hundred and twenty-eight days in her voyage and sailed 16,200 miles. By the Nicaragua route the distance from Port Townsend to Boston is about 5,600 miles and the saving about 10,600 miles, nearly 76 per cent., or, say, more than eighty-three days of her passage, which would amount to a saving in actual expense of $6,225, without regard to the advantage to both shipowner and lumber merchant in their economies of time, insurance, and use of capital, which upon her cargo could not have been less than $40 per day, or an aggregate of $3,300 more.

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*75 per day for costs includes interest upon cost of vessel, insurance, depreciation of value, repairs, wages, and provisioning.

Under such advantages as the canal would offer an enormous coastwise commerce in coal, provisions, lumber, and the various commodities of commerce, the traffic in which is largely dependent upon advantageous transportation, would of necessity be developed, the magnitude of which it is impossible to estimate. The same reasons will operate to divert to the canal a very considerable portion of the trans-continental traffic from China, Japan, Australia, and the Sandwich islands, which has been diverted originally from the Cape Horn route, and now constitutes a large part of the tonnage of the Panama or Pacific railroads. It is in this view of the matter that we have included in the table of commerce the traffic between these countries and the port of San Francisco as tributary in a degree to the canal.

There should also be added to the table a proper estimate of the proportion of the commerce between Great Britain and her East Indian colonies which will seek the Nicaragua Canal as a return route in perference to the Suez Canal, because of favoring winds and currents, more favorable temperature, and other reasons which the merchant will be quick to discover.

The first item mentioned, existing traffic between the Atlantic and Pacific coasts of the continent not otherwise included, has been estimated at figures varying from 265,531 tons in 1887 to 275,000 tons in 1888, distributed as follows:

	Tons.
Between Atlantic and Pacific ports of United States, around Cape Horn	145,713
British Columbia with Europe, around Cape Horn	69,818
To which add similar tonnage by the Isthmus of Panama, estimated at	50,000
Estimate of 1887	265,531
For 1888 the following estimate has been made:	
E. P., 3-24-88. By Panama	75,000
Between Atlantic and Pacific ports of United States, around Cape Horn	185,000
British Columbia with Canada, around Cape Horn	15,000
	275,000

In this last estimate the trade of British Columbia with Europe is entirely omitted as apparently of no value; we may, however, assume that it was not less in 1888 and 1889 than in 1887, say 70,000 tons, and we may safely accept less than the mean of the two years, this included, as a just estimate of the annual amount, say, in round numbers, 275,000 tons.

As we have already included in the table of tributary traffic the commerce of Asia and the Pacific Islands with San Francisco, we make no separate estimate of the proportion of it which ought to be attracted to the canal, but in the distribution of the total consider it as among the probably tributary business. It is admitted without question that a considerable portion of this trade is directly with the inhabitants of the Pacific coast and for local consumption, but a certain proportion of it is transshipped by rail across the continent for consumption or distribution at points not ports of entry and where it can not be shipped "in bond.' This portion of the trade would, because of the comparative cheapness of water transportation, be attracted by the canal, for the difference in time of transit by the canal and that of entry at the Pacific port, reshipment, and of freight transportation by rail across the continent would not be sufficient to warrant the additional cost of overland transportation; indeed, it would probably consume quite as much if not more time than the route by the canal. The time from Hong-Kong to New Orleans by steamer through the canal would be less than via San Francisco by steamer and rail from thence to New Orleans.

The value of the return commerce between Great Britain and her East Indian colonies remains to be considered. It is possible that the export trade from Great Britain to the East Indies will always seek the route by the Suez Canal, but there are reasons in the favoring winds and currents and more temperate climate to traverse, which make it exceedingly probable that the return voyage may be made more speedily and therefore less expensively, and at the same time more comfortably, by the Nicaragua Canal than by the route used for out-bound trade. It is not impossible, however, that the northeast trades which carried Columbus so successfully to Porto Rico may sufficiently favor the out-bound voyage to attract even some portion of that trade, but there is no room to doubt that the canal will exert an attraction on that which is homeward bound. Moreover, not an inconsiderable part of the material of this traffic, such as plumbago from Ceylon and straw braid from China is immediately transshipped from London to New York for consumption in this country. What part of the export trade will seek the Nicaragua route may be disputed, but of that which now moves to Great Britain from that portion of the world the canal may with reason expect a fair share. The total of these imports into Great Britain from her East Indian possessions amounts to nearly $200,000,000 per annum.

To recapitulate. The amount of traffic, thus indicated, which would be attracted to a greater or less degree, by the Nicaragua Canal to-day, if it were open to business, is briefly:

The aggregage of the table	$825,110,167
The return trade from India and the Straits Settlements to Great Britain	195,683,679
Total value	1,020,793,846
Add to this value the trade of Hamburg with Australia, reported in quantity ... tons..	65,300
The Atlantic and Pacific coastwise trade of the United States and British Columbia and other trade (not included in table) ... tons..	275,000
Amount in bulk, not valued ... do...	340,300

It remains to reduce the statistics of value to a tonnage basis and to distribute the whole in such a manner as shall clearly show the relative importance of the canal to the parts thus distributed.

"Lev." In the estimate of the Statistical Commission of 1879 it was calculated that 1,000,000 tons of the aggregate of commerce to be regarded as tributary to the canal consisted of flour, guano, and other low-priced commodities, which should be valued at 200 francs, or, say, $40 per ton. The remainder was valued at 375 francs, or $75 per ton, and the result was the estimate, after liberal allowance made, of 5,250,000 tons already cited.

When the low values of the commodities which constitute the great bulk of material transported are considered, it may well be questioned whether this valuation was not too high, and the allowance for low-priced commodities too small. As corroborating this opinion the following approximate values are submitted:

	Per ton
Coal is worth, say	$3.00
Crude oil is worth, say	16.00
Refined oil is worth, say	25.00
Sugar is worth, say	44.00
Flour is worth, say	50.00
Wheat is worth, say	35.00
Corn is worth, say	15.00
Guano is worth, say	30.00
Nitrates are worth, say	3.20

Reference.		Tons.
S. F. J. C., 90	The wheat and flour fleet from San Francisco carried in 1889, 692,500 tons (over 90 per cent. wheat), mostly to Europe.	692,500
S. Y. B., 405	Chili exported in 1888 of nitrates (680,000 of which which went to Europe, 80,000 to the United States).	760,000
S. Y. B., 405	Of guano (estimated from report of value)	40,000
S. Y. B., 405	Of wheat (estimated from report of value)	150,000
	Peru exported in the same year:	
S. Y. B., 809	Of guano	14,000
S. Y. B., 809	Of nitrates	1,773,135
	And Bolivia exported:	
S. Y. B., 387	Of nitrates, by way of Arica; Peru (estimated from report of value).	124,000
	Making a total of	3,553,635

The statistics of Chili, Peru, and Bolivia for 1889 are not yet accessible, but the business was larger than for 1888.

Of this total over 2,650,000 tons was of nitrates, 1,897,000 tons of which was cubic nitre, worth only about $3 per ton at place of shipment and valuation. Coal and coal oils, crude and refined, enter largely into outbound freights, and, being also articles of low valuation, must materially affect the general average of values. That this tonnage, as well as its return freight, or rather the outbound freight of which it is the return, would be almost entirely tributary to the canal, is evident from the fact that the canal will cut out from the voyage, as between San Francisco, Callao, Appendix A. Valparaiso, and Liverpool, in the first case, 6,996 miles; in the second, 4,090 miles, and in the third case, 2,144 miles, including the stormy, dangerous, and destructive* passage around Cape Horn. The difference from Valparaiso, the principal port of Chili, may not be sufficient to counterbalance the charges of the canal, but from Callao and ports north of it there can be no question as to the advantage to be gained by its use.

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* Destructive in its wear and tear upon vessel and rigging.

Following the method of the statistical commission, which, so far, is the best that has been suggested, and modifying it only to pay regard to ascertained facts, we may deduct from the aggregate of the table the following items as not open to estimate, their value and quantity both being already determined:

Reference.		Tons.	Value.
	Wheat and flour from South American ports (page 10)	150,000	$3,411,532
	Guano (page 10)	54,000	1,762,389
	Nitrates (page 10)	2,657,135	30,013,199
		2,861,135	35,187,120
S. F. J. C., 90	Wheat and flour from San Francisco (page 10)	692,500	21,527,725
	Total	3,553,635	56,714,845

We have remaining a valuation of $768,395,322 as the balance of the table on page 6 for which to determine a tonnage equivalent.

For this purpose we have much information that is of importance in relation to averages of value. The total foreign commerce of the United States for year ending June 30, 1889, is reported as follows (merchandise only):

References	Entered and cleared.	Tons.	Imports and exports.	Value.
C. & N., 810	Entered, cargo only	12,913,400	Imports	$745,131,652
C. & N., 812	Cleared, cargo only	14,263,430	Exports	742,401,375
	Total	27,176,830		1,487,533,027

Average value, $54.74 per ton.

Complete statistics for Great Britain, France, and Germany are as yet accessible only for the year 1888. In that year the commerce of Great Britain with other countries is reported as follows:

References.	Entered and cleared.	Tons.
S. Y. B., 85	Entered, cargo only	27,077,000
S. Y. B., 85	Cleared	31,664,000
	Total	58,741,000

References.	Imports and exports.	Value.
S. Y. B., 79	Imports	$386,582,026
S. Y. B., 79	Exports	298,047,374
	Total	684,629,400

Average value, £11 13*s.* 2*d.*=$58.28.

Of France the commerce is reported as follows (foreign trade by sea):

References.	Entered and cleared.	Tons.
S. Y. B., 488	Entered, cargo only	13,537,734
S. Y. B., 488	Cleared	9,354,225
	Total	22,891,959

References.	Imports and exports.	Value.
		Francs.
S. Y. B., 486	Imports	3,629,000,000
S. Y. B., 486	Exports	2,955,000,000
	Total	6,584,000,000

Average value, 288 francs=$57.60.

S. Y. B., 549. Of Germany the only statistics which are in a form available for use are those of the port of Hamburg, which is the principal port of entry of the German Empire. Out of a total tonnage of 17,489,235 tons entered and cleared at the seven principal ports of Germany in the year 1888, Hamburg is credited with 8,846,117 tons, being over 50 per cent. of the whole. For some reason not stated no return is made of the value of exports, but the value of imports at that port is given as follows:

S. Y. B., 577.	Imports by sea, weight	kilos..	3, 884, 422, 400
	Exact equivalent	tons..	3, 823, 786
	Value	marks..	1, 114, 906, 000

Average value, 291 marks=$72.75.

We have, then—

Countries.	Tons.	Per ton.
Great Britain	58, 741, 000	$58. 28
France	22, 891, 959	57. 60
Germany, Hamburg (imports only)	3, 823, 786	72. 75
United States	27, 176, 830	54. 74
Total	112, 633, 575	
Average		57. 77

Statistics of the commerce of the British Colonies in Australia and New Zealand may be regarded as free from exaggeration of the repeated entries and clearances, before mentioned, as vitiating returns of tonnage on the Pacific coast. From them we gather the following data:

Commerce of New Zealand in 1888.

References.	Entered and cleared.	Tons.
S. Y. B., 254	Entered, cargoes	456, 237
S. Y. B., 254	Cleared, cargoes	524, 874
	Total	981, 111

References.	Imports and exports.	Value.
S. Y. B., 252	Imports, exclusive of specie	£5, 430, 050
S. Y. B., 252	Exports, exclusive of specie and gold	6, 487, 897
	Total	11, 917, 947

Average value, £12 3*s.* =$60.75.

The commerce of Queensland, Australia, in 1888 was:

References.	Entered and cleared.	Tons.
S. Y. B., 262	Entered	478, 5
S. Y. B., 262	Cleared	517, 7
	Total	996, 229

References.	Imports and exports.	Value.
S. Y. B., 261	Imports	£6, 646, 738
S. Y. B., 261	Exports	6, 126, 362
	Total	12, 773, 100

Average value, £12 16*s.* 5*d.* =$64.10.

The commerce of Victoria in 1888 was:

References.	Entered and cleared.	Tons.
S. Y. B., 286	Entered	2,182,071
S. Y. B., 286	Cleared	1,125,812
	Total	3,307,883

References.	Imports and exports.	Value.
S. Y. B., 284	Imports	£23,972,134
S. Y. B., 284	Exports	13,853,763
	Total	37,825,897

Average value, £11 8*s.* 6*d.* = $57.10.

The commerce of New South Wales in 1888 was:

References.	Entered and cleared.	Tons.
S. Y. B., 237	Entered	2,414,750
S. Y. B., 237	Cleared	2,350,669
	Total	4,765,419

References.	Imports and exports.	Value.
S. Y. B., 235	Imports	£20,885,557
S. Y. B., 235	Exports	20,859,715
	Total	41,745,272

Average value, £8 15*s.* 5*d.* = $43.85.

In the returns of the Australian colonies the tonnage of vessels arriving and clearing in ballast and of specie and bullion exported and imported are not separated from the general aggregates, and make the average of tonnage valuation obtained from them less useful than those obtained from the commerce of the four great nations; but the including of specie and bullion in export values overbalances the including of vessels entered and cleared in ballast, and the tendency is to make an increased average value. This is demonstrated by the returns of New Zealand as compared with those of Victoria and New South Wales. They serve, then, notwithstanding their defects, to corroborate the other estimates in a general way, although they are not of specific value in themselves.

The commerce of New Zealand, of which the statistics are properly divided, showing the tonnage of cargoes entered and cleared and the values of imports and exports, exclusive of specie, bullion, and gold and silver, shows an average value of $60.75 per ton. It embraces in its aggregate all the commodities, in similar proportions, which go to make up the commerce of other Australian countries, and its average, therefore, is of direct value.

Deducting from the total tonnage and the total value of the commerce of Europe, which amounts to 85,456,745 tons, at a valuation of $5,018,674,000, the total tonnage and value of the nitrates, wheat, etc.—say 3,553,635 tons, valued at $56,714,845—which goes almost entirely to Europe, and which has been deducted similarly from the table of values, the average value per ton of the remainder is $60.59.

From these data, which approximate each other so closely, we may safely assume $61 to be a full valuation for determining the equivalent tonnage of the $768,395,322, remainder of the table of tributary commerce. We have then the following results:

	Tons.
Equivalent of $768,395,322, $61 per ton, average value	12,596,644
Tonnage of Hamburg with Australia, not appraised in table	65,300
Tonnage of nitrates, etc., South America	2,861,135
Tonnage of wheat and flour, San Francisco	692,500
Tonnage between Atlantic and Pacific coasts, United States of America *and British Columbia, etc*	275,000
Total	16,490,57

To this must be added an estimate of the export tonnage from Asia to Great Britain. As many commodities of high value, such as teas, silks, and spices, enter more largely into this trade, in order to convert its value, we may properly advance the tonnage equivalent. One hundred dollars per ton will be sufficient valuation.

The exports to Great Britain for the year 1888 from the following countries were as below:

References.	From—	Value.	Equivalent in United States money.
S. Y. B., 139	India	£30, 763, 677	$153, 818, 335
S. Y. B., 104	Ceylon	2, 532, 999	12, 664, 995
S. Y. B., 158	Straits settlements		29, 200, 349
	Total		195, 683, 679

Equal, at $100 per ton, to	tons	1, 956, 837
To which add tonnage already estimated	do	16, 490, 579
Add for increase of coal-oil exports to Japan, China, etc.	do	237, 934
Aggregate tonnage		18, 785, 350

We have thus 18,785,350 tons as the aggregate of the enormous traffic which exists to-day, to a greater or less degree, within the zone of attraction of the proposed canal. We have now to consider in what varying measure and to what extent this traffic will be attracted.

It will not be questioned that the trade of the Pacific coast, at least from Callao north, with the United States and with Europe will seek the canal as its most advantageous route, provided charges for its use are not prohibitory. The difference in distance between Callao and Liverpool or Plymouth by ordinary sailing route and by the line of the Nicaragua Canal is 4,090 nautical miles. Allowing 110 miles per day as the average capacity of a sailing vessel of 2,000 tons register, and double that, or 220 miles per day, for a freight steamer of like capacity, this saving of distance is equivalent to a saving of thirty-seven days' time for a sailing vessel, or eighteen and a half days for a steamer.

Appendix A.

As the increased capacity and speed of the steamship is proportionately counterbalanced by increased original cost and increased expense of operation, perhaps a full illustration of one class of vessel will be sufficient to warrant an arbitrary statement of premises concerning both.

A sailing vessel of 2,000 tons register will cost for construction, equipment, etc., about $60 per ton, say $120,000.

Twenty-four per cent. per annum is the usual allowance of cost for the following items:

	Per cent.
For interest on cost	6
Insurance	8
Annual depreciation, etc	10
	24

Charge for these items, instead of 24 per cent., say 20 per cent = $24,000 per annum, or $66.40 per day.

For wages and subsistence the cost will be about $1,000 per month, or, say $33.33 per day. Total, say $100 per day.

But such a vessel on a long voyage will lie from thirty to sixty days in port loading and discharging cargo, and this time is equally chargeable to the voyage. Allowing, then, one hundred and twenty days as sailing time between New York or Liverpool and San Francisco by way of Cape Horn, and forty days in port (less than the average) we have one hundred and sixty days for the voyage at a cost of $100 per

day	$16, 000
Add part charges, say	4, 000
Total cost, say	20, 000

Freights pay from $7 to $10 per ton, according to market; assuming $8 as a low rate, a 2,000 ton vessel will earn on her cargo of about 3,000 tons,

Say	$24, 000
Deduct expenses	20, 000
Profit, at low estimate, per voyage	4, 000

The following is an estimate of the saving which would be made by the use of the canal between the ports of San Francisco and Liverpool:

		Miles.
Appendix A.	Distance from Liverpool to San Francisco, by Cape Horn	14,690
	Distance from Liverpool to San Francisco, by Nicaragua route	7,694
	Distance saved	6,996

Equal to, at 110 miles per day, more than sixty-three days; that is to say, sixty-three one-hundred-and-sixtieths of the expenses of the voyage may be saved, or about $6,300, to which must be added an equal proportion of the profits of the voyage because of the increased voyaging capacity through lessened distance, say $1,580, showing $7,880 as the immediate advantage to the shipowner alone of the use of the canal between San Francisco and Liverpool; at higher freight rates the advantage would be proportionately increased—but there are other advantages which can not be so easily computed, yet which will be of great weight in turning the current of trade into this new channel. The increased safety of the voyage and reduced rates of insurance to both shipowner and merchant, and with the merchant, the ability to turn his capital so much more frequently, are arguments of the weightiest importance, which can not be measured by dollars and cents in anticipation, except theoretically, yet added to the facts before stated which are ascertainable, they serve to multiply the evident advantages of the canal route.

There can be no question as to the advantage of the canal to Northern ports; there may be some as to how far south it may be considered preferable to the route around Cape Horn. We do not doubt but that its influence will be felt much farther than is demonstrable, but it is better not to claim too much, for that which can clearly be claimed is abundantly sufficient to satisfy the most exacting inquirer.

We ask attention to the following facts concerning the nitrate trade:

S. Y. B., 809 Cubic nitre is worth at place of production, say from $3 to $3.23 per ton, a low-priced commodity, and freights by sailing vessels are about 32*s.* 6*d.* to 40*s.*, say $8 to $10. In 1888, Peru shipped to Great Britain 1,773,135 tons from the different ports along the coast from Callao to Iquique.

		Miles.
Appendix A.	The distance from Callao to Liverpool, by Cape Horn, is	10,539
	By Nicaragua Canal route it is	6,449
	Distance saved	4,099

	Days.
Time saved at 110 miles per day, thirty-seven days out of a voyage of, sailing days	96
In port	40
	136

Estimating expenses as before, at $100 per day—

They amount to	$13,600
Port charges, say	4,000
Total	17,600
Freight, three thousand tons, at $8	24,000
Profits of voyage	6,400

We have the following as the advantage by use of the canal route:

37-136 of expenses saved	$3,700
37-136 of profits to be added	1,800
Gain	5,500

Allowing a charge of $2.50 per registered ton as the canal toll, it would pay the shipowner at least $500 to use the canal coming from a port as far south as Callao. To vessels from ports within that limit, and to vessels of less tonnage, the ratio of advantage would be proportionately greater. The advantage to the shipper may be computed as follows: Allowing such a ship's cargo (2,000 tons register) to be worth $150,000, that is to say, at the rate of $50 per ton for the cargo carried, which is much below the average, the saving in interest, at 6 per cent per annum, and insurance at 4 per cent per annum, for the thirty-seven days, would be over $1,500, to be added to the $500 advantage to the shipowner. On a cargo valued only at $50,000, which would necessarily be made up very largely of nirate at a low valuation, the saving would be $500 to the shipper, the advantage to the shipowner being the same in either case.

In view of these facts, we may regard the trade of Peru and of the Pacific coast *of the American continent* north from Callao as entirely tributary to the canal.

South of Callao it will become gradually less so until canal tariffs overbalance its benefits, but exactly at what point the division will take place only experience can determine.

It does not seem that further illustrations are necessary; the same methods may be applied to any and every case in which it may be desired to test the advantages of the canal; but investigation shows that where the saving in distance approaches 2,800 miles for a 2,000-ton vessel with a cargo worth $150,000 or over, there will be an advantage to the shipowner and the shipper conjointly, in the use of the canal at a toll of $2.50 per registered ton. To decrease the rate would extend its influence still farther and increase the tributary tonnage in more than a proportionate rate, for the added zone of attraction would be on the outside of an already widely extended circle, stretching out into rich and densely populated territory in Asia. Even at $2.50 per ton it is not impossible that the difficulties of the passage around Cape Horn and advantages of insurance, etc., may bring the trade of Valparaiso as well as of Callao within the zone of strong attraction; we have, however, preferred to treat it, so far as Europe is concerned, as belonging to a class likely to contribute to the canal not more than one-fourth of its volume.

If it be asked: How shall the shipper and the merchant avail himself, each of his representative share, of the advantage to accrue? The answer is: As they have done in the past.

A quarter of a century ago the merchant bought his teas in Hong-Kong or elsewhere, insured and shipped them home; each transaction was the subject of a separate negotiation. To-day he buys them at what is known in New York as a C. F. and I. price, that is to say, Cost, Freight, and Insurance included. The shipper profits by any reduction in insurance or freight which he may be able to obtain, and adjusts his price with reference to it and to promptness of delivery. On the other hand, the buyer suffers no risk of change in freight rates nor any of the embarrasments and costs of rehandling at any intermediate point. This new method of purchase and sale has grown up entirely in connection with the requirements of transcontinental traffic. In like manner trade will provide a satisfactory method to profit by any advantage properly belonging to herself in connection with the canal, probably by a C. T. and I. price, that is to say, Cost, Tolls, and Insurance included; or, if not in that way, then by some more suitable method.

It will aid in arriving at a proper distribution of the traffic if we divide it into three classes, considering the facts just illustrated.

First class: That which will be *entirely* tributary to the canal;

Second class: That which will be *largely* tributary; and,

Third class: That which will be so *partially* and perhaps only in a small degree.

In making the distribution we make use of data already given.

In the first class, that of *entirely* tributary commerce, we place the following:

		Tons.
Trade between Atlantic and Pacific ports, United States, etc., not included in table of values; estimated at		275,000
Trade of Pacific ports with Great Britain, France, Germany, Belgium, Cuba, and Brazil, tabulated at $42,252,304. (In this total is included the value of the wheat export from San Francisco.) It should therefore be divided as follows:		
$21,527,725 wheat and flour, reported at		692,500
$20,724,579, estimated at $61 per ton		339,747
Trade of Atlantic ports of the United States with Hong-Kong, China, Japan, British Australasia, Philippine Islands, Hawaii, Peru, Ecuador, and Chili, amounting to $54,003,533. This also may be divided as follows:		
$6,456,448 for coal oil (C & N., 292)		322,626
$47,547,085, estimated at $61 per ton		779,460
(The division is made for the purpose of adding the increase of coal-oil shipments for the years 1889–'90, which were over 50 per cent greater than those of 1888–'89, as shown by British consular reports of receipts in China, Japan, and British East Indies.)		
Add, therefore, for existing coal oil traffic, 1889–'90, 50 per cent of 322,626 tons		161,313
Coal oil to British, French, and Dutch East Indies from Atlantic ports for 1888–'89 (see Second Class C. & N., 292)	343,242	
Add 50 per cent increase 1889–'90	176,621	
		519,863

(United States Government reports give the export of coal oil, crude and refined, to the countries named for 1888–'89 at 665,868 tons. Messrs. Frazar & Co., of Yokohama, show an increase of shipments received in China, Japan, and British East Indies during 1889–'90 of 294,937 tons, or over 61 per cent increase.)

	Tons.
Trade of Great Britain with Ecuador, Peru, and Bolivia, amounting to $19,003,610. This must also be divided as follows:	
$5,225,170 for nitrates and guano	1,911,433
$13,778,390, estimated at $61 per ton	225,884
Trade of Belgium with Peru, $6,440,905, at $61 per ton	105,589
Total first class, entirely tributary, tons	5,333,415

Second Class—*largely tributary.*

General business between British, French, and Dutch East Indies and New York, $30,127,664.			
Of this total a part has already been considered as belonging to Class 1, viz, the exports of coal oil from Atlantic ports of the United States; there is, therefore, to be deducted $6,275,800 for its value, leaving $23,841,864 which, at $61 per ton, is equal to 390,850 tons, of which we may assume one-half as tributary			195,425
The trade of Central America with the United States will also take place in this class. In 1889 it amounted to $5,170,980, at $61, equal to 84,770 tons, but as much of it is coastwise with San Francisco, and considerable of it fruit from the Caribbean coast to New Orleans and New York, we may take one-quarter only as tributary say			21,192
The trade of Great Britain with Hong-Kong, China, Japan, the Australian colonies, New Zealand, Tasmania, Philippine Islands, Chili, and Central America will be attracted in proportion to distances. It amounts to $457,059,308. This should be divided as follows:			
		Tons,	
Exports of nitrates, guano and wheat, value	$29,962,470	= 950,000	
Remainder	427,096,838, at $61	=7,001,588	
		7,951,588	
Take one-quarter			1,987,899
Trade of France with New Caledonia, Japan, and Chili, amounts to $27,184,683, at $61 equal to 445,650 tons; take one-quarter			111,412
		Tons.	
Trade of Germany with Australia, Japan, and Chili, amounts to $29,106,392, at $61 equal to		477,154	
Add Hamburg with Australia		65,300	
		542,454	
Take one-quarter			135,614
China with Germany, France, and Europe, $18,283,315, at $61 equal to 300,000 tons; take one-quarter			75,000
Total second class			2,526,542

Third Class—*partially tributary.*

In this class we may include—

Trade of Spain with Philippine Islands	$4,123,000
Trade of Netherlands with Dutch East Indies	66,080,000
Trade of Great Britain with Java	22,358,760
Trade of San Francisco with China, Japan, etc	43,915,593
Total	136,477,353
	Tons.
At $61 equal to	2,237,333
To which add for British imports from India, Ceylon, and Straits settlements, as estimated	1,956,837
Total	4,194,170
Of which take one-sixteenth; total third class	262,136

SUMMARY.

	Tons.
First class, entirely tributary	5, 332, 415
Second class, from tonnage largely tributary	2, 526, 542
Third class, from tonnage partially tributary	262, 136
Total	8, 122, 093

This is an approximate estimate of the tonnage existing in 1889 and to-day, which the canal might expect to control if it were open to traffic.

M. Levasseur and his associates in 1879 estimated that the tributary tonnage which might be anticipated for 1889 was 7, 250, 000. Facts more than confirm their expectations, and demonstrate the propriety of their method.

A study of the Table of Distances appended,* and a consideration of the influences operating, will show the principle upon which the division into classes has been made. In taking the fraction of the respective aggregates which the second and third classes may be expected to contribute, we have claimed less, rather than more, than a reasonable expectation would allow. It is with regard to the third class only that any explanation seems necessary as to the reasons which have suggested the claiming a portion of it as tributary. A majority of the trade in this class originates beyond the recognized dividing line of 110 degrees east from Greenwich, especially the trade of India, and can not be expected to pay any large tribute to the canal, except, perhaps, of at a rate as low as that of the Suez Canal, whereas we have assumed $2.50 as the probable toll. The tolls of the Suez Canal, all charges included, amount at present to about $1.96 (9.80 francs) per registered ton. The trade of the Philippine Islands with Spain is not open to the same objection, but, on the other hand, her Mediterranean ports are nearer than the Atlantic ports of that country or of Europe. We have referred to the prevailing winds and ocean currents, and the more favorable temperature of a passage by the Nicaragua Canal rather than by the Red Sea and Suez. These are reasons of some importance in controlling direction. In addition to these reasons much of the business considered is carried in sailing vessels which do not go by the Red Sea route at all; they have to double one or the other of the capes. To them the Nicaragua Canal and prevalent winds and currents will afford advantages which to a steamer might not be of so great importance. Moreover, there is a large traffic which now goes from this region, first to England or other parts of Europe and comes to us from thence, which, when the canal is open, must and will come direct. Large quantities of plumbago used in the foundries throughout our country is carried from Ceylon, where it is mined, to England, and then sent here to supply our needs; thousands of tons of straw braids from China, and other commodities from other parts follow the same route. These are the sufficient reasons for assuming to claim a portion, and we have claimed only a very small portion, of the enormous trade of these remote points.

Thus far we have considered the question with reference only to what exists to-day, and our conclusions are based upon statistics for the years 1888 and 1889. Allowing that the canal will be ready for traffic in the year 1897, and admitting our estimates to include all increase realized in 1889 by the countries whose statistics are given only for 1888, we have eight years growth of commerce to make allowance for in estimating the amount of business which at the opening of the canal will be ready for transit.

For the ten years, of which 1888 was the last, the commerce of the four great commercial nations shows the following increase:

Countries.	1879.	1888.
Great Britain	$2, 977, 204, 200	$3, 336, 087, 844
France	1, 917, 186, 874	1, 830, 682, 200
Germany	1, 841, 726, 925	2, 306, 258, 318
United States	1, 278, 762, 621	1, 417, 172, 421
Total	8, 014, 880, 620	8, 890, 200, 783

Increase, $875,320,163, or about 10.9 per cent.; prices of staple commodities have changed but little during the time, except that wheat is about 10 cents per bushel lower, but they have rather declined than advanced. The tonnage equivalent would therefore not be materially changed. We may then estimate the advance for the years 1888 to 1897, both years included, say nine years, at 10 per cent. But this is only normal growth, and for reasons worthy of consideration, we have the right to expect more than a normal growth of the commerce to which the Nicaragua Canal will afford a means of transit.

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* Appendix A.

With the opening of the canal not only will a new route be provided, but new fields will be opened for commerce as well as more advantageously provided for.

The products of our Alaskan possessions, as well as of Washington and Oregon, mostly low-priced commodities furnishing a large bulk of tonnage, will be brought at less cost to eastern markets, the markets of the western coast of South America will be opened to the low-priced coals of our Southwestern States, and the coasting trade now carried on with the West Indies to the extent of over 500,000 tons per annum will be multiplied beyond calculation. If a traffic of 500,000 tons has been developed within the limits of the Caribbean Sea, what may be expected when the markets of the Pacific coast of Colombia, Mexico and Central America, of the States of Ecuador, Peru, Bolivia, Chili, and of Southern California are opened to easy access for our coasting vessels?

In our existing lake and coastwise trade, steel barges carrying from 1,500 to 3,000 tons freight, transported by powerful tugs, are taken at low cost to market points, and there left to discharge and reload for a return voyage, while their motive power returns without delay with freights, in similar barges, made ready for departure before its arrival. Thus movement of freight is accelerated, invested capital is made to yield its largest returns, shippers profit by the possibility of lower rates, and consumers by the possibility of lower prices. Under such methods the traffic of the Sault Ste. Marie Canal has developed from 1,802,571 tons in 1881 to the enormous aggregate of 7,221,935 tons in 1889, and is exceeding the ratio of that year for 1890. And this traffic has grown up in connection with the internal trade only of a portion of our Northwestern States with the East. Like results will follow similar methods, which are equally possible in the waters opened by the Nicaragua Canal, and American enterprise will not be slow to avail itself of the unprecedented opportunity. What people ever have had such an opportunity put before them? To-day England is practically as near the markets of western South America as we; to-morrow we shall be 7,000 miles nearer than she is to-day in a distance of 10,600 miles by existing routes. We shall still have the advantage over her of the Atlantic's width when the canal is opened, nearer by so many miles to a market for our cotton goods and manufactures of every kind, with machinery, agricultural implements, furniture, woolen goods, carpets, and coal to sell, and the needs of 75,000,000 of people at home to furnish a reciprocal market for the products which they have to offer us. But this is not all, perhaps only the smaller portion of the whole. We have only briefly mentioned the products of our own possessions north of California, the forests and fisheries of Oregon, Washington, and Alaska, and the products of British Columbia.

The salmon pack of British Columbia, Alaska, Washington, Oregon, and California amounted in 1888 to 1,683,800 cases, about 84,200 tons, valued at $9,064,000, exceeding in quantity the pack of 1888 by 527,000 cases; 680,000 cases of the product was from Alaska, and 422,000 from British Columbia. This is a growing industry. The pack amounted in 1880 to only 679,490 cases; in ten years it has increased nearly 250 per cent.; by 1897 at the same ratio of increase it will amount to nearly 3,500,000 cases. Hop growing as an industry was commenced in Oregon and Washington in 1865. Last year the product was 70,000 bales, regularly quoted and competing with other goods in the New York market. The fur-seal and whale fisheries are also growing and important industries.

The cultivation of India rubber in Central America and on the western coast of California is already attracting attention. The increasing demand for the gum and the destruction of trees in their natural state by the reckless huleros or native gum gatherers, makes attention to an artificial supply for future demands of manufacture imperative. Already large manufacturing corporations in this country are making plantations to meet it. The huleros are so careless that not only are they destructive of the trees but much of the gum brought by them to market is in bad condition and commands only 26 cents per pound, whereas when properly collected it is worth as much as 80 cents for the best quality. The tree grows naturally in Central America and Mexico. The western coast of the last-named country, between the ocean and 1,800 to 2,000 feet of elevation above the level of the sea, seems particularly favorable to its best development. A plantation is made with shoots gathered in the forests, and with proper care will be in condition to yield a crop in six or seven years; a tree in good condition yields 10 to 12 pounds per annum, and, if not maltreated, continues to yield year after year, apparently without limit. Its yield is worth, according to quality—which depends chiefly upon its treatment—from 50 cents to 80 cents per pound. This, too, is an industry which will pay tribute to the canal.

But in the forests of the northwestern Pacific coast there is material which needs only the facilities of the canal for its transportation to a favorable market to yield a tonnage which alone will probably exceed that of all other industries combined. The wonderful growth of the lumber trade of that section under present limitations of transportation is an indication of the magnitude to which it will grow with the opening of new and more extended markets by the shortening of distances to them on lines within the still waters of the temperate and torrid zones, instead of by the routes now existing through the tempestuous seas of the storm zone.

E. P., 3, 24, '88. In 1886 the shipment of lumber from Oregon amounted to 6,000,000 feet, equal to 12,500 tons; in 1887, to 48,000,000 feet, equal to 100,000 tons. In 1888 the amount cut amounted to 706,985,000 feet, and the shipments abroad to 471,325,000 feet, equal to 981,925 tons, or nearly 1,000,000 tons.

Concerning the lumber trade with eastern markets, the Post-Intelligencer, of Seattle, Wash., publishes the following under the dates indicated:

July 11. The Sound sawmills (Puget Sound) have lately been filling special eastern and southern orders for extra length stuff. Quite a large number of huge spars have been lately shipped from Sound ports to the east, where there is ever an active market sale for that material.

July 14. The Puget Sound cedar shingles were first endered in the eastern markets five years ago. The demand for them has ever since steadily increased, and now shingle mills all over the Sound are shipping their product east as far as Ohio (*i. e.*, at railroad rates).

The forests of Maine no longer yield the timber needed for masts and spars of large vessels. In the forests of Oregon trees grow to 12 feet in diameter and 300 feet in height. The average length of sticks to Boston from Puget Sound by the bark *Crapo*, in the cargo, the arrival of which has been already mentioned, was 126 feet, and their average diameter 39 inches. Sixty of the sticks were bought by a shipbuilder of Bath, Me., and were made into a raft and towed around to his yard. This fact shows how depleted the Maine forests are of spar timber. Cuba has attempted the importation of lumber for building purposes around Cape Horn, but found the experiment too costly to be continued. In our Southern States their own hard pine, though less desirable, is taking the place of soft pine because of advancing prices. All these demands will be met and supplied from the Oregon and Washington lumber fields with the opening of the canal. Any estimate of what the demand and supply would aggregate is mere conjecture, but considering as a whole the coastwise trade, including mahogany, rosewood, ironwood, and teak of Southern Pacific coasts, the growing trade of Central America in coffee, cocoa, India rubber, mahogany, and other hard woods, the furs of Alaska, and the seal fisheries, whale oil, wheat, canned salmon, and other products of British Columbia, Washington, and Oregon, spar timber and other lumber from the forests, and our outbound trade in coal, textile fabrics, agricultural implements, machinery, iron goods, etc., 1,000,000 tons per annum will seem a very small estimate to put upon it.

Aggregating the various items thus estimated we have the following:

SUMMARY

Of trade which will be subsidiary to the canal at its opening:

	Tons.
Traffic existing in 1889, as estimated	8,122,093
Natural growth of same by 1897 (10 per cent.)	812,209
New business developed by opening of the canal	1,000,000
Aggregate	9,934,302

Which may be considered as traffic properly belonging to the canal, and to be drawn by it from the total of the commerce within the zone of its attraction in 1897.

	Tons.
The aggregate of tonnage within this zone of attraction in 1889 amounted to	18,785,350
Deduct subsidiary traffic existing in 1889	8,122,093
And there remains	10,663,257
To which must be added 10 per cent for growth in 1897	1,066,326
And we have as a remainder	11,729,583

From which the canal, after its opening, may further add to its traffic in such degree as its tolls and the practical development of other controlling influences may determine.

APPENDIX A.

Table showing distances in miles between commercial ports of the world and distances saved by the Nicaragua Canal.

From—	Via Cape Horn.	Via Cape of Good Hope.	Via Nicaragua Canal.	Distance saved.
New York to—	*Miles.*	*Miles.*	*Miles.*	*Miles.*
San Francisco	14,840	....	4,946	9,894
Bering Strait	17,921	....	8,026	9,895
Sitka	16,105	....	6,209	9,896
Acapulco	13,071	....	3,122	9,949
Mazatlan	13,631	....	3,682	9,949
Hong-Kong	18,180	15,201	11,038	4,163
Yokohama	17,679	16,190	9,363	6,827
Melbourne	13,502	13,290	10,000	3,290
New Zealand	12,550	14,125	8,680	3,870
Sandwich Islands	14,230	....	6,388	7,842
Callao	10,689	....	3,701	6,988
Guayaquil	11,471	....	3,053	8,418
Valparaiso	9,750	....	4,688	5,062
New Orleans to—				
San Francisco	15,052	....	4,047	11,005
Acapulco	13,283	....	2,409	10,874
Mazatlan	13,843	....	2,969	10,874
Guayaquil	11,683	....	2,340	9,343
Callao	10,901	....	2,988	7,913
Valparaiso	9,962	....	3,987	5,975
Liverpool to—				
San Francisco	14,690	....	7,694	6,996
Acapulco	12,921	....	5,870	7,051
Mazatlan	13,481	....	6,430	7,051
Melbourne	13,352	13,140	12,748	392
New Zealand	12,400	13,975	11,349	1,051
Hong-Kong	18,030	15,051	13,786	1,265
Yokohama	17,529	16,040	12,111	3,929
Guayaquil	11,321	....	5,890	5,431
Callao	10,539	....	6,449	4,090
Valparaiso	9,600	....	7,436	2,144
Sandwich Islands	14,080	....	9,136	4,944
Spain to Manilia	16,900	13,951	13,520	431
France to Tonquin	17,750	15,201	13,887	1,314
Hamburg to—				
Mazatlan	13,931	....	6 880	7,051
Acapulco	13,371	....	6,320	7,051
Fonseca	11,430	....	5,530	5,900
Punta Arenas, Costa Rica	11,120	....	5,515	5,695

From—	To eastern entrance of Nicaragua Canal.	From—	To western entrance of Nicaragua Canal.
	Miles.		*Miles.*
New York	2,021	New Orleans	1,308
Liverpool	4,769	San Francisco	2,776
Hamburg	5,219	Valparaiso	2,518
Amsterdam	4,994	Callao	1,531
Havre	4,874	Portland	3,219
Cadiz	4,220	Victoria	3,428

NOTE.—The distances have been measured by customary routes most convenient for sailing ships and slow freight steamers.

APPENDIX B.

AUTHORITIES AND ABBREVIATIONS.

C. & N.—Annual Report on Foreign Commerce and Navigation for year ending June 30, 1889. Treasury Department, U. S. A., Government Printing Office, 1890.

S. Y. B.—The Statesman's Year Book of Facts for 1890, MacMillan & Co., London and New York, 1890.

Lev. —Rapport de M. Levasseur sur le Commerce et le Tonnage relatifs au Canal Interocéanique, lu en Séance Genérale du Congres Internationale, 1879.

E. P. 3, 24, '88. —Evening Post, March 24, 1888, Article on the Nicaragua Canal; figures from U. S. Bureau of Statistics, year ending June 30.

S. F. J. C. *'90.*—San Francisco Journal of Commerce, Annual Review, February 6, 1890.

HEARING BEFORE A SUBCOMMITTEE OF THE COMMITTEE ON FOREIGN RELATIONS OF THE UNITED STATES SENATE, THURSDAY, MAY 22, 1890, IN RELATION TO THE NICARAGUA CANAL COMPANY.

The subcommittee met at 1 o'clock p. m. Present: Senator Edmunds (chairman), Senator Dolph, and Senator Payne.

Senator Edmunds read the following resolution:

IN EXECUTIVE SESSION, SENATE OF THE UNITED STATES,
April 11, 1890.

Resolved, That the Committee on Foreign Relations be, and it hereby is, directed to inquire into what steps have been taken under the act of Congress entitled "An act to incorporate the Maritime Canal Company of Nicaragua," approved 20th February, 1889, and what are the present condition and prospects of the enterprise; and to consider and report what, in its opinion, the interests of the United States may require in respect of that interoceanic communication.

Attest:
ANSON G. MCCOOK,
Secretary.

STATEMENT OF HON. WARNER MILLER.

By Senator EDMUNDS:

Q. What, Mr. Miller, is your present relation to the company that I assume was organized under the act of Congress to incorporate the Maritime Canal Company of Nicaragua, approved February 20, 1889?—A. I am the president of what is known as the Nicaragua Canal Construction Company.

Q. What sort of company is that, and under what law organized?—A. That company is organized under the laws of Colorado—a general law of the State.

Q. Have you a copy of the articles of your association here present?—A. I have not.

Q. Who is the president of the Maritime Canal Company of Nicaragua?—A. Mr. Hiram Hitchcock.

Q. What are the relations between your construction company and the canal company organized under this act of Congress?—A. The canal construction company, of which I am president, has contracted with the Maritime Canal Company to build the canal.

Q. Well, was a company organized under this act of Congress? I thought until this moment you were president of that company.—A. The Maritime Canal Company was regularly organized under that act and exists to-day, having its offices and board of managers, and has fully complied with the law.

Q. And Mr. Hitchcock is the president of that company?—A. He is the president of that company.

Q. Do you know who make up the whole body of directors of the company organized under the act of Congress?—A. Mr. Hiram Hitchcock, Mr. Hotchkiss, Mr. Stout, Admiral Ammen, Mr. Goodwin, Mr. Fairbanks, the Nicaraguan minister and others.

Senator PAYNE. Suppose you furnish a list with full names and residences.

Mr. MILLER. I will do so with pleasure.

By Senator EDMUNDS:

Q. You, then, Mr. Miller, as the president of the Construction Company, have undertaken to do the work, so far as it is yet provided for, of the company organized under this act of Congress?—A. Yes.

Q. Now, will you please tell us how much money, so far as you know, has been actually raised that can be drawn upon, and how far you have expended it, and what has been done on the Isthmus down there, in detail—not minute detail, of course—but so that we can see just how far you have got on and what you are doing. State it in your own way.—A. Before the granting of this charter by Congress an association of gentlemen existed, the Nicaragua Canal Association, who subscribed money which was used for making the preliminary surveys, and for all the work pending the securing the concession from the Government of Nicaragua. That association raised and expended between a quarter and half a million dollars—I have not the exact figures, but prooably in round numbers not far from $300,000—in making surveys in order to settle to their own satisfaction as to whether a canal could be built and the work that was necessary to secure a concession. After that was completed, the Construction Company was organized, and they raised the money which has been expended upon the canal during the first year. That stock was all properly subscribed for and had been paid in by installments, until now there remains two installments of 10 per cent. to be paid in upon that. Out of that money the work has been carried on during the past year.

(Memorandum.—Mr. Miller here produced a pamphlet entitled "Maritime Ship Canal, Nicaragua, 1890," with inclosed maps and delineations, and referred to map marked A, representing, on a small scale, both oceans and Lake Nicaragua, Greytown, Brito, and the river.)

Mr. MILLER. I will make a general description of what we have done and ask Mr. Menocal to give you a more detailed account of the engineering work that has been done and is in progress. A year ago the first expedition of the new company was sent out to Greytown, and that expedition established our headquarters at a point where the Nicaraguan Government decided the entrance of the canal should be, proceeded to erect warehouses, barracks, headquarters for the officers and the engineering corps, and also a hospital. From this site we sent out six engineering parties, consisting of six engineers and twenty men each, who have been constantly engaged in the location of the canal and making the surveys, so much in detail as to enable the company to lay before contractors completed details of the work.

Q. That, then, is the actual work of location?—A. Yes. Aside from the engineering work the first work undertaken with the canal proper has been that of opening the harbor at Greytown. The harbor at Greytown has been closed for twenty-five years by a bar being formed across the mouth of it. All communication had to be had by ships lying outside and going in in small boats and lighters.

Q. Is that harbor within the area of the mouth of the river?—A. The harbor that we are to occupy——

Q. No, I mean the old harbor. Where is Greytown with reference to the mouth of the river that flows out of Lake Nicaragua?

Mr. MENOCAL. It is at the mouth of one of the outlets of the San Juan River.

Mr. MILLER. The harbor which the company has taken as its harbor and which it has undertaken to improve is the old harbor as it existed twenty-five or thirty years ago, which consists now of an inclosed basin, being entirely shut off from the sea by a bar which has formed across the mouth of it. That harbor is of sufficient capacity for all the vessels that can ever go through the canal—for a large fleet. It has from 14 to 20 feet of water now.

Q. Is that harbor at or near what was formerly one of the northern outlets or at present of the river?—A. Yes; it was the northern outlet and the most important outlet thirty years ago, but that was closed by a bar and the river has broken through to the southeast. The first work done in connection with that was to build a pier or breakwater from the harbor out to a line of 30 feet of water at sea.

Q. Crossing that bar?—A. Crossing that bar, and for the purpose of dredging out a channel alongside the pier when it was constructed.

Q. How far out is that pier?

Mr. MENOCAL. The breakwater will have to be about 2,500 feet long.

Q. Well, how far out from the main-land is this bar?—A. This bar extends 2,000 feet from the main-land.

By Senator DOLPH:

Q. Do you expect to get any greater depth of water in the harbor after opening a channel through the bar?—A. The harbor is to be dredged out to 30 feet, the same as the bar. The first work was to build a pier or breakwater.

By Mr. EDMUNDS:

Q. Wait a minute; I want to find out the hydrography and topography of it inside of this bar, which I will assume to be 2,000 or 3,000 feet out on the shore line. How deep is the water?—A. As I just stated, it varies from 14 to 20 feet.

Q. And on the bar there is only 6 or 8 feet, I suppose?

Mr. MENOCAL. Yes, and even less than that, because this river had broken out at another place and what used to be the outlet is now entirely cut off from the sea.

Q. And the great volume of the water goes to the southeast?—A. Yes.

By Senator DOLPH:

Q. What is the rise and fall of the tide?—A. Only 18 inches.

Q. Is there any considerable swell?—A. Yes.

Q. How does it compare with the coast of California?—A. Very much less. The swell there on the bar is very seldom 4 or 5 feet, and generally very much less.

By Senator EDMUNDS:

Q. Proceed, Mr. Miller, with your general statement of the substance of things you have done and are doing.—A. The company began building this pier or breakwater, which is to extend to the bar and out to deep water, or 30 feet of water at sea. That pier has been extended out about 700 feet. It is constructed first of creosoted piles, which will resist the attacks of the terredo, 40 feet wide, and the piles are driven into the sand at great depth, so as to make it very secure. Then it is filled in with loose rock in order to make it absolutely secure, and thus far the work has gone on most satisfactorily.

Q. Are there any cross-timbers between the piles?—A. It is all heavily framed together.

Q. Makes a crib in fact, though it is not sunk and piled with pile on the outside?—A. Piled with piles and then to be filled with large rocks eventually. An immense breakwater will eventually cover this entire piling and make it perfectly secure.

Q. So that this crib-work, we might call it, will be protected finally with a riprap?—A. A riprap covering the whole of it. This breakwater is constructed at such an angle as to anticipate the shifting of the sands along the beach, and the channel is to be dredged on what we call the lee side of the breakwater. The first work after the building of this breakwater has now got out to a depth of 12 feet at sea; so we propose to commence now the dredging of the channel through the bar in order that vessels of light draught, like schooners and sailing vessels which we want there with material, may be able to come in and save lighterage. Once inside the bar they are in a perfectly inclosed basin or harbor, with 18 feet of water, entirely sufficient for ordinary vessels.

The contract for dredging this bar and harbor to a depth of 20 feet has already been let, and the first dredges are now on the way to Greytown, having sailed from this country a few days ago. Two other dredges are being built, and will go forward in the course of a few weeks. The first cut across the bar is at a depth of 12 feet of water. That, under contract, is to be completed in one hundred and twenty-five days. Then the second cut is to be 20 feet, and that is to be completed in one hundred and twenty-five days more. When the first cut is made we can get in with schooners and vessels such as we are sending down, and when the second cut is made we shall be able to go in in good-sized steamers. The company thought it wise to do this work first, because one of the important engineering questions was whether a safe harbor could be made at this point. Without trespassing upon Mr. Menocal's statement of engineering work, I will say that this harbor when open will be substantially an inclosed harbor in which the river San Juan will be shut off, having its mouth where it is now, further south and east, so that whatever débris will come down will never be deposited in this harbor, so that when it is once dredged out there is no reason why it will not remain perpetually, because it is entirely an artificial harbor and entirely inclosed.

Q. If I understand you, once the breakwater being built and the cut through the bar into the deeper water inside being made, this very bar itself forms against storms a shelter for vessels, as breaking the seas down?—A. Yes.

Q. So that nature has built this harbor for you, providing you once cut your way into it?—A. Yes, it is a breakwater now.

Q. Now, about what is the size of that inclosed area, that being thus formed will allow vessels to come in where without any dredging you could get, say, 20 feet of water—how broad a space?

Mr. MENOCAL. It is about 2 miles wide by 1 mile as to the size of the the lagoon or basin we are going to convert into a harbor.

Mr. MILLER. It will be a perfect basin 1 by 2 miles.

Q. Now go on, Mr. Miller, and tell us what else you have done.—A. The final line of the canal, the engineering work, has been done down to Ochoa, the dam from which point we use the lake. The distance *from* Greytown to Ochoa by the line of the canal is 30 miles, and that engineering work has been substantially completed. The definite line of the canal has been located and the engineers have taken borings of all the cuts that have to be made. Where the rock cut is located we have bored down toward the bottom of the canal at distances of 1,000 feet apart, and we have samples of all the kinds of rock and material, so that we can show the contractors and engineers precisely the kind of material they are to meet with.

Q. This distance of 30 miles brings you to the river below the rapids or to the lake, does it?—A. It brings us to the river, at which point we dam the river where it is on the level of the lake.

Q. From that point where you dam the river below the rapids how far is it to Lake Nicaragua?

Mr. MENOCAL. Sixty four and one-half miles.

Q. What have you done on that line? Have you got water enough?

Mr. MILLER. We have advanced to Greytown, and have been clearing the line of canal of the dense tropical growth and have cleared probably one-half of the distance from Greytown to the first lock, or more than that across the lagoon. This material has all been cut down, a dense growth, and during the late dry weather it has been burned over, so that it is ready for the dredgers. In addition to that we have commenced the construction of a fresh-water aqueduct 13 miles long to bring fresh water from the mountains down to Greytown in order to preserve the health of the men and to give us pure and fresh water.

Q. What sort of an aqueduct is that?—A. This aqueduct is composed of a steel pipe, covered inside and out with asphalt to preserve it from rusting, and it is estimated it will furnish Greytown and all of our ships and barracks and hospitals with pure drinking water.

Q. What about is the length of that?—A. It is about 13 miles in length.

Q. What is the head?—A. One hundred and fifty feet.

Q. That will give you a good head?—A. Yes.

Q. Have you told us about the hospital work, if any, and the state of health, and how many men you have got there altogether, and how the thing has appeared in respect of the possibility of white men living there and carrying on this work?—A. Among the first things that the company did was to organize a medical department and erect hospitals. They had sent the buildings down complete, having been built in New York, and appointed a chief surgeon and four assistants. The result has been that we have a perfect record of the health of all the men who have been in the employ of the company during this year from the hospitals, which have been kept very carefully. There has been no epidemic and no serious sickness on the force at all. The hospital records show that the two principal diseases have been chills and fever and diarrhea, diarrhea caused by the drinking of the bad water in the lagoons, as the men would do of course when they were in camp and surveying parties. The chills and fever seem to have been very light in their attacks, as the records show that the majority of the men going into the hospital have stayed not more than three days or a week, perhaps an average of four to five days in the hospital from chills and fever.

Q. Can you tell us what has been the percentage of mortality since you have been there among all the persons who have been in the employ of the company?—A. I believe that there has not a single person died in the employment of the company from any disease contracted there. One or two men have been killed by the natives and in drunken quarrels.

Q. I mean mortality from diseases of the country?—A. The only case that can be charged of that, and perhaps not even that, was one mechanic who was sent down from New York and became dissipated and was discharged for drunkenness and sent home, and after being home some weeks he died, it is perhaps not to be charged even to the climate, but all the engineers, all the machinists of all kinds, who are all Americans from the United States, not a single one of them has died there, and sickness has been, as I stated, chiefly due to the two causes and it has been very slight as to them.

Q. Then, if I understand you, you mean to say that, so far as your experience has now gone, with Northerners going down there, the state of the climate is not such as to give any serious apprehension at all?—A. That is the experience of the first year.

Q. Yes, as far as you have gone?—A. And the hospital records very fully show it, and from this time on the conditions ought to be very much better than they have been, because now we have houses and barracks and everything that belongs to a civilized man, and we shall very soon have pure water for all to drink, and we have not any doubt that that will remove almost entirely the cause of diarrhea and dysentery, as to the engineers and machinists who are now there, and have been there for a year and become acclimated; and the late returns from the hospital show that the number of men in hospital is very much less than it was six months ago. There have been on the average during the past year five hundred men in the employ of the company during the whole year.

Q. If you know, tell us what is the highest temperature that is experienced there?—A. Well, I get my information from Mr. Menocal on that, but I understand the highest is not over 95°.

Mr. MENOCAL. Eighty-four or 85 is the average at noon and about 75 in the evening; generally about 75 in the night.

By Senator DOLPH:

Q. That is at Greytown?—A. Yes.

Q. I suppose it is higher as you go into the interior?—A. As you go into the interior it is cooler in some places, and in some places warmer; but I never saw it above 90 or below 70. The lake region is never above 80.

By Senator EDMUNDS:

Q. Well, that is the presentcondition of the thing as it appears on the surface of the earth.

Mr. MILLER. We have not got through with detailing our work yet. We built a short line of railroad from the beach up into the town in order to move the materials from the landing-place, about 2 miles of road, and we have made completed surveys for a line of railroad from Greytown to what we call the divide or the rock cut where the locks are to be laid, and the rise is made which brings the canal up to the level of the lake. Seventeen miles of surveys of that road are entirely completed and it is now in process of construction.

Q. I thought Mr. Menocal said the distance was 30 miles?—A. No, the distance is 17 to the divide, and then we rise up and run through a cut or basin like to the Ochoa dam, which is thirty miles.

Q. There you have reached the level of the lake which the dam will produce?—A. We reach the level of the lake then. We reach it at the third lock. You understand we come out of the lake a distance of 65 miles down the San Juan River and at that point we leave the river entirely and cut straight across to the ocean, saving a distance of 30 or 40 miles by reason of the river becoming very sinuous and crooked through the swampy ground. We leave the river entirely at Ochoa dam and go straight across to the sea. This railroad is now in process of construction. The construction was begun about six weeks ago, the first work, and there are now at work upon it at least five hundred men. We have shipped down steel rails, two locomotives, a large number of flat cars for completing the road, together with steam shovels and pile-drivers and all the necessary machinery for the completion of this road, which is to be finished early in the fall. The necessity of this road will be seen from the condition of the country. It is impossible to move any machinery or any supplies of any quantity over this low marshy ground or lagoons in any other way. It is an absolute necessity that we should build the railroad and we build this first piece of railroad 17 miles until we strike what is called the great rock cut, or divide, which is the heaviest single piece of work on the entire line of the canal, and we build the railroad to attack that first. It will take one or two years to do that. Then the rest of the work we cut at as soon as possible, when everything that is necessary for this great cut can be easily moved from the sea into the interior.

Q. What sort of a country does that cross?—A. The first 10 miles entirely level, largely swamps, and the rest only a very few feet above the level of the sea.

Q. Where do you get your material for making your embankment or whatever you call it?—A. We get it on the sides of the road itself. The swamps are quite dry now at the end of the season and dirt is thrown up and what is not got that way is to be taken from the seashore by trains, for which purpose we send down cars.

Q. That is sea-sand?—A. Sea-sand taken right from the mouth of of the canal. We get a large part of it right out of the mouth of the canal, so that while we are building the railroad we are excavating the canal at the same time. When we reach this rock cut at the end of 17 miles we shall begin to take rock out and take it down to Greytown to complete this breakwater, or pier as we call it. A very large amount of the rock from the cut will be used. (The rock cut is marked *a* on the map with red pencil.) In addition to the work on this railroad the company began early to build a telegraph line from Greytown up to Castillo to meet the Government telegraph.

Q. Where is Castillo?—A. It is 24 miles below the lake on the river San Juan. The company constructed about 75 miles of telegraph line and has it in operation, connecting Greytown with the Nicaragua Government telegraph, which comes down to Castillo; so that we are in telegraphic communication with our headquarters at Greytown all the time by this line, which it is of course very important that we should have.

Q. Is there anything else that you have not already stated in regard to the actual operations that you have already carried on there?—A. Nothing perhaps of very much importance in the way of work that has been done.

By Senator PAYNE:

Q. Have you stated how many men there are in your employ?—A. We have now nearly if not quite a thousand men employed on the pier and upon the clearing and upon the line of the canal and upon the railroad, and are constantly sending more in from Jamaica. We are shipping down large quantities of railroad material and machinery.

By Senator EDMUNDS:

Q. Supposing you have a thousand men now employed, how many of those are Americans, for instance?—A. Probably not more than two hundred—one hundred to two hundred and fifty of those are Americans. The entire engineering officers and all the skilled laborers, foremen, stationery engineers, locomotive engineers, and men that work on the pier and the pile driving—all the skilled work is in the hands of American citizens whom we have sent from New York.

Q. Out of all these during the time you have now been operating, as I understand you, there has been no serious climatic disease to make it extra dangerous for a person from the United States to go there?—A. That is correct; there has been no serious sickness of any kind and no deaths among any of that force.

Q. Where do you get the rest of your labor, the men who merely pull and dig?—A. We get some native Nicaraguans, but we get the bulk of them from Jamaica—Jamaica negroes—and some come from the West India Islands, etc.

Q. Now take the native Nicaraguan, what sort of people are they as laborers in respect of intelligence, capacity, and so on?

Mr. MENOCAL. They are a very good class of men, very industrious, and preferable to any other class of laborers that I have been able to obtain.

Q. They are real hardy, effective laborers, are they?—A. Yes, excellent men.

Q. Are they willing to work?—A. Yes.

Q. What do you pay for labor down there?—A. We are now paying about $15 a month, American money, or 20 soles, and feed and board the laborers. Of course we give them their board and quarters.

Q. Now, Mr. Miller, if you have finished the general statement about the present situation——

Mr. MILLER. I might just add one more thing in regard to that. We found on the San Juan River a steam navigation company which had chartered rights from Nicaragua, and as they had the exclusive right of navigating the river with steam and the lake also, we found it necessary to become the owners of that line in order that we might prosecute our work and use it; and under the concession we had a right to do that, and we took in this entire steam-ship line, with its vessels and everything connected with it, and are now carrying it on. We use it, of course, as a means for delivering our goods and carrying our supplies up the river and up the lake.

Q. What was the name of that line before you took it?

A. The Nicaragua Mail Steam Navigation Company.

Q. Who were the people? Were they people living there?

Mr. MENOCAL. Mr. Pellas.

Q. When was this concession made to the steam-ship line?—A. The concession was made—I know it was renewed in 1877 or 1878. It had been made before to an American by the name of Hollenback and he afterwards sold it to Mr. Pellas, an Italian, who became interested in this navigation company and bought it, then the concession that Mr. Hollenback held lapsed in 1877 or 1878 and a new concession was granted to Mr. Pellas.

Q. Direct?—A. Direct.

Q. Was that an exclusive concession?

Mr. MILLER. The exclusive privilege of navigation by steam on the lake and river.

Q. Have you within reach that you could give us a copy of that Nicaraguan concession?—A. I have not any copy here. I have one in New York.

Q. Is it in print, so that you could send us a copy without serious inconvenience?—A. Of the navigation company?

Q. No; I mean this navigation company that you bought out.—A. It may be in print, but if it is in print it is in Spanish.

Q. I do not care about that. I wish you would send us a copy.—A. Yes, I will.

Q. Now, you had to take this company in order to execute the mission you had in hand?—A. Yes.

Q. Now, are you willing to tell us, in the confidence of this committee and running the risk of its getting out, how much you had to give for that?—A. Three hundred thousand dollars.

Q. Was that the maritime canal company chartered by Congress or your construction company?—A. Our construction company. We had to buy it before we could do anything.

Q. So that has become a part of your plant?—A. A part of our plant.

Q. And when your contract with the Congressional canal company is executed you get back your $300,000?—A. The company will undoubtedly have to go out of existence then, as the railroad will be completed and the canal will be completed and there will be no use for it.

Q. Yes, but if it is an exclusive privilege, and your construction company now owns it, suppose the canal were finished to-day, then the question is, you, a different company from the Congressional company, are the proprietors of the exclusive privilege of navigating Lake Nicaragua by steam?—A. Yes.

Q. Now what is going to happen?

Mr. MENOCAL. This exclusive privilege is only for the internal commerce of Nicaragua.

Q. Purely internal commerce?—A. Yes, the rights of the interoceanic canal are reserved by Nicaragua.

Q. So that, notwithstanding this exclusive grant for local traffic, the right of the Congressional company to transfer vessels from the Atlantic to the Pacific, and *vice versa*, would not infringe upon that grant?—A. Not at all.

Q. Very well, now I understand.

Mr. MILLER. As to our present work, we are sending forward to Nicaragua a large amount of railroad material, and also a complete machine shop capable of building machinery or of repairing it; also a furnace for making cast-iron, as there is no foundry in the republic at all. There is no way of getting a piece of iron without sending up to New York for it, and we need a large amount for the completion of the pier and material for the completion of the railroad. In fact we have three vessels now on the way loaded with material and two more under chater loaded with coal and railroad iron, everything that is necessary to carry on this work to complete what I have said, the dredging of the harbor and building the railroad, the dredging of the harbor being of the first importance, as we want to get in, and the building of the railroad in order to get into the interior.

Q. And cut off the forest, as I understand you?—A. The two important things which the company found were first, to open the harbor, and second, to build a line of railroad 17 miles in until we struck hard ground or rock. That work is being pushed with great vigor. That is to be finished by early fall. That is substantially the condition of the work.

Q. How much money has been spent altogether there now in round numbers?—A. In round numbers from the beginning I suppose about $3,000,000.

Q. That includes the $300,000 paid to this local transportation company?—A. No, not including that; outside of that.

Q. Well, is there money in hand in one company or the other to complete the things that you have already described as in progress?—A. There is money enough in hand or in sight that is subscribed that will come in in the regular order.

Q. That is, available assets?—A. Yes, sir, available assets that will complete all the work we have contracted for. I started out with the proposition that we would make no contracts for work beyond what we could see our way clear to pay for. The construction company, I will say, has already taken means to bring into its treasury a million and a half more of money, which will come in unquestionably within the next few months, so that when these two works are completed that we are now at we will go on to the western end of the canal and lay out the work the same way there. All the work that has been done so far in the way of establishing headquarters, houses, shops, and hospitals has been laid out on a scale calculated to be sufficient for the prosecution of the whole work whenever we shall have the money in hand to do it. We think we have not wasted any money at all, and have not done anything in a little or petty way. We have started to lay out the work so that when we are in a condition to push it along the whole line our organization will be as complete as that of any army and we can carry it on systematically and thoroughly, protecting all the rights of the company and protecting ourselves against frauds of all kinds. We have a complete police system which I have not mentioned, which we have a right to under the concession. We have to maintain a police force with these various nationalities in order to preserve the peace and take care of our property. In short, the work, I think, has been laid out in the beginning in such a way as to make every dollar count and to put the work in such a condition to push it to a completion at the earliest possible moment whenever the financial arrangement has been made or money sufficient to do the work.

Q. So that, so far as you have gone, every step that has been taken and all the money that has been expended has been a direct and economical means to the end of actually constructing that canal?—A. That is my judgment about it. It has been done economically, and, so far as we have gone, it has been done below our own estimates for the same work.

Q. Are you willing to furnish the committee with a copy of the contract between your construction company and the Maritime Canal Company, so that the committee may know what are the relations and reciprocal duties and obligations of the two companies?—A. I should prefer to consult the board of directors in regard to that. I can say, generally, this in regard to it. We have undertaken to construct a canal for the securities of the company which may be issued against it. Some points of that contract are still left open because it has been impossible to determine exactly how much money would be required until we knew more of our own financial schemes, so that we could determine more fully what the securities would bring in the public market; in short, that the Maritime Company should undertake to issue securities enough, which, when sold in the market, would bring money enough to complete the canal. And, whilst the question of financing the whole thing has been going on, the amount that should be issued or the interest that the bonds should bear has been left open for further negotiation.

Q. Are you a director in the Maritime Canal Company?—A. I am not.

Q. You have no connection with that?—A. No connection with it at all.

Q. How much is the capital stock of your construction company, the Colorado corporation?—A. Twelve million dollars.

Q. How much has been actually paid in; what percentage of that $12,000,000 stock has been subscribed?—A. Well, some of that stock was issued to the original association for the work they did in procuring the concession and the moneys which they paid out for the preliminary surveys, which extended over two years of time. Just how much there was of that I am not able to say without going back to the books. The stock of late, $4,000,000 of it, was issued at 50 cents on the dollar, money actually paid in on it, and more of it, one and a half millions, we expect to issue substantially at par.

Q. How much is now actually outstanding; how many shares of the $12,000,000?—A. I think about ten and a half millions is out.

Q. Representing paid-up stock?—A. Yes.

Q. The Maritime Canal Company you know, by the act of Congress, is required to report once a year to the Secretary of the Interior a full account of all its transactions, so that if it made a full report this contract between itself and your railroad company would appear, and therefore I should suppose it would be proper for us to ask you, and for you to respond, although you do not happen to be a member of that very company, to let us have a copy of the contracts which shows the relations between the Congressional corporation and the Colorado one.—A. Well, I do not think there will be any objection to that, although, as I say, that contract has not been fully completed. It was not at the time of that report.

Q. The sixth section of the act incorporating the Maritime Canal Company of the 28th of February, 1890, provides:

> SEC. 6. Said company shall make a report on the first Monday of December in each year to the Secretary of the Interior, which shall be duly verified on oath by the president and secretary thereof, giving such detailed statement of its affairs, and of its assets and liabilities, as may be required by the Secretary of the Interior, and any willfully false statement so made shall be deemed perjury and punishable as such. And it shall be the duty of the Secretary of the Interior to require such annual statement and to prescribe the form thereof and the particulars to be given thereby.

A. That report was made, but the contract was not fully completed at that time, and in fact it is not fully completed yet, because, as I say, it was left open substantially because on certain conditions we should have to have more securities to build the canal than we should on other conditions.

Q. Now, Mr. Miller, I wish you would tell us about the prospects and plans for raising money and the methods that you yourself can consider as being feasible and how much and all about the future of the finances, how you are to get the money and on how much discount and how much the real cost of the thing is to be and how much in any way you can negotiate securities for, and what will be the outstanding obligations as distinguished from actual money to be paid out for all expenses.—A. The estimate of our chief engineer, Mr. Menocal, is that the actual cost of building the canal, outside of any interest or commissions or anything of that kind, will be in round numbers $65,000,000. His report and estimates are here presented. When Mr. Menocal's surveys were completed they were submitted to a board of consulting engineers consisting of five engineers of distinguished ability and character. They went carefully over the estimates of Mr. Menocal, and their report, which is herewith presented, makes an estimate of the total cost in round numbers of $73,000,000, and then they say that, to cover all possible contingencies of construction, they add 20 per cent., which amounts in round numbers to $14,000,000. That makes their grand total estimate in round numbers $87,000,000. As to the correctness of Mr. Menocal's estimate I can say this: Several very skillful contractors, men who have had large experience in building public works, especially railroads in the West, have been over the line of the canal and given a great deal of time to the consideration of the plan and details upon the ground itself, seeing what obstacles they had to overcome and what difficulties there were in the way. One of those contractors, after having made three several visits to Nicaragua, said to me that he would put in a bid for the entire western division of the canal, that is from Lake Nicaragua to the Pacific Ocean, including the harbor at Brito and the three locks on the western side, which bid would be less than our own estimates. I only mention that to give you an idea as to whether the estimates are correct or not. Of course unforeseen difficulties may arise and the cost may be increased, but the company, after these two years of examination and consideration, believe that the cost of the canal can never under any circumstances exceed $100,000,000.

By Mr. PAYNE:

Q. That embraces his estimate for the extras?—A. Yes. Now as to the method of raising this amount of money, of course it can only be done by selling the securities of the company. They consist, or will consist, of stock and bonds. Since I have been president of the Construction Company I have consulted with many leading financial men in the country, and of course it is impossible to say at this time at what price bonds of the company could be negotiated, but I am frank to say that I do not believe that they can be negotiated at par or very near it. This is a peculiar enterprise, which presents many obstacles, and of course it will be looked upon by the investing world as somewhat problematical. The first bonds of the Suez Canal, I believe, netted the company only about 60 cents on the dollar. How much more than that we shall be able to obtain for our bonds I am unable to say, but I have no doubt but what the bonds can be negotiated in the markets of the world at a price much above that of the first Suez bonds.

The present intention of the company is to make arrangements with what would be called a syndicate of bankers, getting one large and reputable banking house to take the lead in the matter, and that house to associate with itself a large number of banking houses in this country and in London and in Amsterdam and in Frankfort and in Berlin—houses which are now in the habit of associating themselves together for the placing of large loans or the placing of a large amount of securities—and expect to make a contract with the leading house, the head of the syndicate, to take these securities and market them as best they can, so as to give us somewheres in the neighborhood, we will say, of ten to fifteen millions of money per annum as the work shall go on.

Banking houses are ready to undertake this work, and the only question about it is a question of commissions and the question as to what price the bonds shall go to the public at in order to induce them to take them. We can not expect the public will come in and take these bonds unless they are offered to them at such a price as to give them a large profit in case the work succeeds. This project is entirely different from the project of building a railroad and issuing bonds upon it as it is constructed.

The interest on money used upon the construction is a proper charge of the cost of construction as much as the money that goes into iron or into labor or anything else. People who put their money into an enterprise expect the interest will be charged against construction until the work is completed, so that we have to provide not only for the cost of the work as it goes on, but we must provide for the interest on the bonds until such time as the canal is finished and begins to earn.

We assume that it will take six years to build this canal from the time we have money enough to push it with vigor; that is to say, if we were to have our negotiations completed for the placing of our bonds at the end of this year and could begin to get our money at the next year we should count it would take six years from next January to complete it. If a bond is issued I presume it can not be floated at less than 5 per cent. interest. If we were six years in building the canal there would be three years' interest to pay upon the entire issue of bonds, whatever that might be, and how large that issue will have to be is, of course, dependent upon the price we may obtain for the bonds. The company has hoped that it would get such a price for the bonds as would enable us to pay this interest and pay the cost of construction and give a fair profit to those connected with the enterprise by the issuing of not more than $150,000,000. Whether that can be done or not I can not say at this time, but I feel very confident that bonds of the company can be marketed, and at such a price as will enable us to complete the canal.

Q. What allowance do you make for the stock?—A. We have not as yet made any calculation upon the stock, holding it in reserve and not issuing it at all unless it should be found necessary. Of course the bonds will go on the markets of the world and they will go wherever the money comes from. This, in short and substantially, is the plan of the company if it is left to itself.

By Senator EDMUNDS:

Q. Is that the plan of the Construction Company or of the canal company?—A. That is the plan of the Construction Company. The Construction Company takes these bonds and agrees to negotiate them.

Q. They are to be the bonds of the canal company?—A. They are to be the bonds of the canal company entirely.

Q. And you are to float them the best way you can?—A. Yes.

Q. I understand you to say that Mr. Menocal's estimate is $65,000,000?—A. In round numbers, yes; and the board of consulting engineers went over his figures, taking the same points, and made it $73,000,000, and then they said, "to cover all possible contingencies we think it wise to add 20 per cent. to that."

Q. That would make $87,000,000 in round numbers.—A. Yes.

Q. Now, I understand you to say that on the credit system of putting off bonds or stock, or whatever way of doing it, the thing would stand in as a capital or loan on which interest or dividends have to be paid out of the income of the concern when done, would be up toward $150,000,000?—A. My judgment is that to get that amount of money we should have to issue at least $150,000,000 of bonds at 5 per cent interest.

Q. But a positive obligation then, when the thing is done on the credit system by raising a loan, would be in round numbers $150,000,000?—A. Yes.

Q. On which interest and finally principal would have to be paid, for an actual expenditure with the 20 per cent. for unforeseen contingencies, of $87,000,000?—A. Yes, but in addition to that you must add interest on the bonds during the process of construction. The interest accruing during the process of construction is as legitimate a charge upon the construction as the building of a lock.

Q. Yes, but it is only interest upon the money that is used that year. So it is not an interest on the $87,000,000. It takes six years to build it. It is an interest on $14,000,000 or $15,000,000 annually?—A. No, it would be the interest upon the entire sum. We will suppose it takes six years to build the canal, and during the six years we issue $150,000,000 bonds, in equal proportions each year, distributed over the six years. Then it would be three years' interest upon the whole amount. It would be an average of three years.

Q. At 5 per cent.—that is 15 per cent. on $150,000,000?—A. That would be $7,500,000 interest for a year on $150,000,000 at 5 per cent., and three years is $22,500,000 interest. That is a proper charge, as much as engineering work is a charge. That is the way all financial operations are carried on.

Q. But then, after all, if your stock in the Maritime Canal Company for this practical purpose—it does not make any difference which we call it—is taken up to the extent of $87,000,000, the utmost estimate, and allowing 20 per cent. for anything the experts can think of on this $87,000,000, you are going to pay interest for the three years on $150,000,000, and in the end you have got the $150,000,000 to pay. That is the difference between the cash system of positive money and borrowing, is it not?—A. That is it exactly.

Q. Very well; that is just what I want to find out. Now tell us, in a general and condensed way, what the outlook is for business, and what you know in respect of the business of the Suez Canal, which is the only thing which can be compared with it?—A. If $150,000,000 of bonds are issued for the building of this canal the fixed charge upon the revenues of the canal for interest will be $7,500,000 per annum. It is assumed that the canal can be maintained and operated for $1,000,000 a year. The cost would be $8,500,000 per annum for the fixed charges of the canal when completed.

Q. Then you would have to add to that, of course, the salaries and other things, unless they are included?—A. No, they are included in the $1,000,000; that includes the maintenance; that would be officers and every repair that might be made.

Q. And all the incidental and all expenses are included in $1,000,000?—A. Are included in $1,000,000. As to the earning capacity of the canal the only precedent we have is that of the Suez Canal, which began operations in 1879, and the receipts of the Suez Canal for 1888 were $12,975,000.

Q. What year did that canal begin its operations.—A. It began in 1879.

Q. Have you got a table that will show it wholly from year to year?—A. I have got it each year.

Q. I wish you would state it. It will be very interesting to come in there.—A. I do not know whether the first year is a full year or not. In 1879 the receipts were $5,595,000; in 1880, $7,501,000, which of course was a full year; in 1881, $9,619,000; in 1882, $11,346,000; in 1883, $12,350,000; in 1884, $12,029,000; in 1885, $12,422,000; in 1886, $11,297,000; in 1887, $11,565,000; in 1888, $12,975,000. For the year 1889 we have not the report as yet.

By Senator PAYNE:

Q. Now what was the cost of that? Have you got it there?—A. Between $98,000,000 and $100,000,000 in round numbers.

By Senator DOLPH:

Q. Have you got anything to show the charges, the rates of toll, and the actual tonnage of the canal—for instance in 1888?

By Senator EDMUNDS:

Q. The tonnage, the expense account, and all that, so as to show the net there?—A. I do not know whether it is all printed here or not. I have got it at home. It will be noticed here that the income fell off a little between and to 1886, and at that time there was a reduction made in the rate of tolls. The rate of tolls was reduced. Then in 1888 they recovered to its highest point. The toll now is $1.80 per ton.

Q. Is that per ton of measurement or per ton of cargo; probably the registered ton?—A. Yes. The tolls at Suez at the beginning were $2.50 per ton, and then reduced to $1.80.

Q. Have you got a table there which shows an increase of tonnage, if there was any, following the reduction of tolls?—A. I have the number of ships and the net tonnage. The first year, 1879, it was 2,263,000 tons; the next year it was 3,057,000; the next year it was 4,136,000; the next year, 1882, it was 5,074,000; in 1883 it was 5,775,000; in 1884 it was 5,871,000; in 1885 it was 6,335,000; in 1886 it was 5,767,000.

Q. That was the year of the Egyptian war?—A. Yes. In 1887 it was 5,903,000; in 1888 it was 6,640,000.

Q. Have you the expenses of operation?

By Senator DOLPH:

Q. Have you the number of vessels?—A. I have the number of vessels. In 1879 the number of vessels was 1,477; in 1880, 2,226; in 1881, 2,727; in 1882, 3,198; in 1883, 3,307; in 1884, 3,284; in 1885, 3,634; in 1886, 3,100; in 1887, 3,137; in 1888, 3,440. The vessels have increased in size and are fewer there, you see.

By Senator EDMUNDS:

Q. Now how does the expense account run?—A. The expense account I have here only for one year; that is for 1888. For administration—that means for the officers, $207,914; for operation, $521,137; for maintenance and renewals, $378,007; making a total of $1,207,058 as against a gross income of $12,975,315.

Q. Leaving a balance of apparent net of how much?—A. The net receipts, $11,678,257, for the year 1888.

By Senator PAYNE:

Q. Now according to your judgment, Mr. Miller, how would the business of this canal compare with that of your canal?

Senator **Dolph**. If you will excuse me for a moment, does that item for operation include the expense of towage; are they sail vessels that navigate the canal?

Senator **Edmunds**. There are very few, but there are some. I suppose there is an additional charge for towing?

Mr. **Miller**. Certainly. A sail vessel going through there would have to pay for its towage just as it does in a harbor elsewhere.

By Senator **Edmunds**:

Q. Now give us your calculation as to what the Nicaragua Canal would have to do and the business it would accomplish?—A. The first estimate made of what the probable business of the canal would be was made at the Paris conference in 1879, which De Lesseps called for the consideration of this question. At that conference I believe the tonnage then estimated that would pass through that canal was 5,000,000 tons.

Q. That is the Panama Canal?—A. I think their estimate, taking the commerce of the world, that would be tributary to the canal—that was estimated at the beginning would be about 5,000,000 tons per annum. The exact figures I have not here, but I can get them and send them to you.

Q. I wish you would. Do you know what the comparative distance is between London and Paris and Havre, all that region of Great Britain, Liverpool, London, Bristol, Havre, Gibraltar, and all the British Channel ports to Japan and China going by Suez compared to the distance going by the Nicaragua Canal when it is done and perfectly complete to carry ships that wish to go?—A. Well, I have got all of that. I referred to it generally. I have right here the estimate of what the business of the Panama Canal would be in 1879. It amounted to 4,570,000 tons, and it is made up of the trade that was then known to exist, the trade that was then going around the Horn and would naturally go by this route if open, and in this document, which I will leave, is given the nationality of the trade—where it would go. In 1879 it was estimated at 4,570,000 tons, and taking this percentage of increase previous to that time and giving the percentage now, it is estimated at the present time the trade that would seek this line is, in round numbers, 7,000,000 tons per annum.

By Senator **Dolph**:

Q. A large proportion of that must be sailing vessels.—A. That is very largely sailing vessels now, undoubtedly, but undoubtedly it would very rapidly change into steam vessels when the canal was completed.

Q. Have you a statement of our commerce upon the Pacific coast estimated from the number of ships or tonnage?—A. Not since 1879, but I can get it and send it to you.

Q. Oh, it is not material. I do not care about it.—A. It is believed that the business will largely increase between the west coast of the United States and the Atlantic coast; that a very large growth of business will take place from Puget Sound, which is to-day the greatest lumber region of the world, and that the lumber from Puget Sound which does not go into the Atlantic Ocean at all will find an immense trade the moment it is open. Now it goes to the west instead, to China and Japan, and it is said they have the largest forests in the world from which the world must draw its supplies. What that growth of commerce will be it is impossible to accurately estimate. The people upon the Pacific coast and in California and in Puget Sound believe that in five years the trade will more than double.

By Senator EDMUNDS:

Q. What rate of tonnage do you think that kind of commerce, of the cheapest and most bulky materials like lumber, etc., could bear for the advantage of going through the Nicaragua Canal? By tonnage I mean tolls, of course.—A. Well, the concession from Nicaragua allows the canal company a maximum of charge of $2.50 per ton, the same as the Suez Canal in the start had. Between New York and the Pacific coast the saving by this route between New York and San Francisco is, in round numbers, 10,000 miles.

By Senator DOLPH:

Q. Two dollars and fifty cents per ton on a thousand-ton ship would be $2,500 toll?—A. Yes.

Q. What would be the probable cost of towage of a sailing vessel?—A. Well, it is estimated a vessel will pass through the canal in twenty-four to thirty hours. A sailing vessel will be towed by a good vessel—one tug would take two in probably about thirty hours.

Q. Could they navigate at night?—A. Oh, yes; of course. The larger part of the distance is in the open water, in the lake and in the river, and of course that will all be lighted perfectly so that it can be navigated in the night as well as in the day. The ordinary cost of chartering a tugboat of that kind in New York Harbor, one large enough to do that, would be not to exceed $40 a day.

By Senator PAYNE:

Q. What is the length of the Suez Canal?—A. Ninety-eight miles.

Q. And yours is how much?—A. The entire distance across Nicaragua is 170 miles, but there are only 27 miles of it canal; the rest of it is river and lake navigation—that is, open navigation through which you can go at fair speed, and vessels can pass each other.

By Senator EDMUNDS:

Q. Well, $2,500 for 1,000 tons, carrying lumber for instance from Puget Sound to New York, how many thousand feet, board measure, of lumber would a thousand-ton vessel carry?—A. I could not give you the figures without going to the books to see what the weight is, but we are chartering vessels all the while to carry lumber, building our shops and our pier, and they carry from 350,000 to 500,000 feet, board measure, and we are paying about $5,000 freight from New York to Greytown, a distance of 2,000 miles, for sailing vessels.

Q. You pay $5,000 for carrying 350,000 feet of lumber?—A. Yes.

Q. What is the tonnage of vessels carrying 350,000?—A. About 600 tons. And that is not an excessive freight at all. That freight is very close. That is the cost of the freight. Now, if you were to send that vessel around the Horn—the distance from New York to Greytown is only 2,000 miles——

Q. Yes, but the thing I want to get at is this: Take Puget Sound lumber, which I will assume laid on board a vessel of 1,000 tons at Seattle and contains 500,000 feet is at a cost of $10,000. Now, then, the question is, how much that 500,000 feet of lumber has got to pay to get through that canal per thousand feet; how much the cost to whoever owns it would be enhanced to the people who could buy and sell it, so as to see whether the lumber trade of Puget Sound could stand a tax of that amount of money—$2,500 on 500,000 feet of lumber—to go through that canal? That is what I want to get at, because you say you expect this to be a part of your expected traffic.—A. Well, you misunderstood me there. That is no part of our estimated traffic. The traffic we have estimated on is a traffic we know to exist. That is simply prospective. It is no part of the estimate that was made in 1879 of the traffic that would go through the Panama Canal, and it is no part of the 7,000,000 tons we have estimated to now exist, because that traffic does not exist. We simply speak of that as a prospective growth of trade.

Q. And the traffic you have already calculated on is the traffic with China, Siam, etc., composed of silks and spices and coffee and tea and so on?—A. No; that does not go around Cape Horn, and therefore we have not estimated it.

Q. Exactly what I want to get at is whether the lumber trade of Puget Sound could stand a tonnage of $2.50 a ton for 500,000 feet of lumber; whether it could go through and still find a market?—A. I understand your question, and I think I had better not endeavor to make any arithmetic answer to it here, but I will take that problem home and have it worked out.

Q. Well, just take hold of it and have it worked out.—A. Yes, I understand just exactly what it is. As a partial answer I simply referred you to what it cost to send a vessel of 600 tons from New York to Greytown carrying 350,000, board measure, at a freight of $5,000. I simply threw that out as a statement. I will have the computation made showing exactly the difference between sailing around the Horn or coming across as to the amount that would be spent in freight, and I will also take up the question of moving wheat from California to Liverpool that now goes around the Horn. I will have those figured out accurately and send them over to you, so that it can go with this statement.

Q. Is there anything else you think of to state?—A. I do not know as there is. I am willing to answer any questions.

Q. One other question Mr. Evarts has suggested. In your looking forward to raising the means to carry on this enterprise, where do you and your friends expect that this money is to come from; from citizens of the United States or from citizens of other countries?—A. We expect it will come from the whole world if we put out our bonds, and my judgment is that the bulk of the money will come from abroad, where all of our great enterprises go. Our people are very much interested in this whole question. I can say that, being at the head, the president of the company, we are getting a great many inquiries from all over the United States in regard to the undertaking, and the whole newspaper press of the country has taken it up and shown great interest in it; but we are getting to hear a great many inquiries from financial people in Europe. They are coming direct and sometimes coming through their agents in New York, who are constantly coming to us for information as to this enterprise, as to what it proposes to do and what its financial plan is.

By Senator PAYNE:

Q. Practically you will have to negotiate with a large house in New York or London and they will coöperate in forming a grand syndicate.

By Senator EDMUNDS:

Q. Yes, but suppose that at the end of ten years from to-day the canal is done and $150,000,000 are out to have accomplished it, where do you think, from your knowledge of all these transactions and the ways of human affairs, these bonds when the thing is done at the end of this ten years will be? Will they be held chiefly by the people of the United States or chiefly by the people of some other countries?—A. I think at least two-thirds of them will be in Europe.

Q. Have you described on what length of time you expect these bonds to be put out?—A. I have said nothing about that, and that is one of the questions between the two companies that is still open—that has not been decided—what the length of the bonds should be.

Q. Well, what do you think yourself?—A. I think it will not be less than fifty years and it may be even longer than that. I do not know whether the proposition has been much discussed of making them ninety-nine years or not.

STATEMENT OF CHIEF ENGINEER A. G. MENOCAL.

By Senator EDMUNDS:

Q. What is your present relation to the maritime canal across the Isthmus of Panama?—A. I am chief engineer of the Nicaragua Canal Construction Company.

Q. Have you been connected with the previous surveys of the Isthmus?—A. I have been connected with all the surveys that have been made in Nicaragua since 1872.

Q. Will you explain to us, in a brief and condensed way in view of what Mr. Miller has already said, what the present state of your operations there is, what you have actually done in respect of final location and work upon that final location, and the prospective work that is to be done, so that we can see at a glance, in view of these maps that have been presented, just how far you have got on?—A. The proposed Nicaragua Canal is the result of many years of explorations and surveys conducted under the auspices of the United States Government and of private parties, and of exhaustive surveys made by a numerous and well organized corps of competent engineers of the Nicaragua Canal Construction Company, from December, 1887, to the present date, for the final location of the route and careful examinations and studies of all the work required for the completion of the canal from the Atlantic to the Pacific. No problem has been left unsolved, and all doubtful elements may be regarded as eliminated.

The canal as finally located lies in the lowest depression of land in the Cordilleras, between the Arctic Ocean and Cape Horn, and traverses a salubrious and fertile country, rich in natural resources and capable of great development. Lake Nicaragua, a large inland sea of fresh water, and its outlet, the river San Juan, occupy a large area of this depression. The surface of the lake is 110 feet above the sea-level and its western border is less than 12 miles from the Pacific coast, from which it is separated by a low divide of 42 feet above the lake-level. The lake is 100 miles in length, has an average width of about 45 miles, and a variable depth, reaching in some places 165 feet.

The proposed canal extends from the harbor of San Juan del Norte (Greytown) on the Caribbean Sea to Brito on the Pacific. The total distance from ocean to ocean by sailing line through canal and lake is 169.45 miles, of which but 26.78 miles will be wholly in excavation, the other 142.67 miles being through Lake Nicaragua, the San Juan River, and artificial basins. Of the latter distance, 102 miles will have a depth of 30 feet or more, requiring neither dredging nor excavation.

The lake is the main feeder and the summit level of the canal. It is *connected* with the Pacific Ocean by 11.40 miles of canal in excavation and 5.27 miles of artificial basin created in the valley of Tola by the construction of a dam across a narrow gorge of the valley, 3 miles distant from the Pacific coast.

From the lake eastwards the canal follows the river San Juan for a distance of 64½ miles to Ochoa, where by the construction of a dam across the river the surface of the water is raised 55 feet and slack-water navigation secured along that distance, converting that portion of the river into an extension of the lake. Just above the dam the canal leaves the bed of the river and enters into a chain of artificial basins formed by the construction of a series of dams and embankments and short cuts, confining and connecting adjacent valleys for a distance of about 12 miles to the western end of the great divide cut. The heaviest work in the whole line is now encountered in crossing the divide separating the valleys of the San Francisco and Deseado Creeks, where nearly 11,000,000 of cubic yards of rock and earth excavation are concentrated in a distance of 2¾ miles. However, the rock is hard and homogeneous, there are ample natural facilities for doing the work; the rock is needed for the construction of breakwaters, locks, dams, embankments, etc., and if not found in that favorable center of distribution it would have to be quarried at other places.

Easterly of the divide cut there is another artificial basin about 5 miles long formed by the construction of a dam across the valley of the Deseado, and thence 12 miles of canal in excavation extending to the harbor of Greytown, of which nearly 10 miles will be at the level of the sea.

The summit level of the canal extends from the western end of the basin of Tola to the eastern end of the Deseado basin, a distance of 154 miles. It has been stated that this upper level is 110 feet above the sea-level. This elevation is proposed to be overcome by six locks, three on the Atlantic and three on the Pacific slopes—the lifts of these locks varying from a maximum of 45 feet to a minimum of 25 feet, their uniform length being 650 feet and the width 80 feet.

The harbors of Greytown and Brito need to be enlarged and improved by the construction of breakwaters and by dredging, but the works required present no serious engineering difficulties.

With the exception of the rock cuts in the eastern and western divides, the canal prism will be at all points wide enough for two ships to travel in opposite directions, and its least depth will be 30 feet. In the lake, the river San Juan, and the artificial basins vessels can travel with entire freedom.

The computed quantities of excavations, embankments, and fills, as determined by a careful location of the entire route, study of all accessory works, and borings to the depth of necessary cuttings, are as follows:

	Cubic yards.
Dredging below sea-level	29,823,161
Earth excavation above sea-level	21,773,810
Rock excavation	13,452,938
Rock excavation under water	575,445
Total excavation, earth and rock	65,625,354
Rock fills for dams and breakwaters	4,033,810
Earth fills	6,105,380
Stone pitching	202,641
Concrete in locks and retaining-walls	615,651

It is estimated that the canal can be completed in seven years, of which one year will be consumed in preliminary work.

The estimated cost of construction of the whole canal and the two harbors is $65,000,000. This estimate has been revised by a board of consulting engineers, who, after allowing a large percentage for possible and remote contingencies, have fixed the total cost of the work at $87,000,000, exclusive of commissions, banking, and interest during the time of construction.

The capacity of the canal for traffic is estimated at 32 vessels per day, or 11,680 in one year; which, based on the average tonnage of vessels passing through the Suez Canal, will give an annual capacity for traffic of over 20,000,000 tons. By passing more than one vessel in each lockage, the above estimated capacity may be largely increased. The present traffic of the Suez Canal is about 3,500 vessels, with a tonnage of about 7,000,000 tons annually.

The water required for thirty-two lockages in one day is 127,400,000 cubic feet, while the lowest flow of the lake in the dry season is 11,930 cubic feet per second, or in one day 1,272,530,600 cubic feet; consequently the lake supply alone is ten times the maximum needed for the operations of the canal.

The time consumed in passing from ocean to ocean by steamer is estimated at twenty-eight hours, which includes one hour and twenty minutes for possible detention in narrow, rocky cuts.

The business of the canal at the time of its proposed completion in 1897, based on reliable statistic information, is estimated at 7,000,000, of which more than half will be between ports of the United States, or the United States and other countries; but the natural growth and development of the Pacific States and Territories, greatly promoted and materially increased by the opening of the canal, will add millions of tons of traffic to the canal which present information fails to show.

WORK ACCOMPLISHED.

From December 1887 to June 1890, the Nicarauga Canal Construction Company had a numerous corps of engineers constantly employed exploring all possible routes, and making a careful survey of the one finally selected as possessing the greatest facilities, with the least doubtful problems, for the construction of the canal. More than $300,000 were expended in these surveys.

The first expedition for construction left New York on the 25th of May, 1889, and on the 3d of June landed at the proposed entrance to the canal from the Caribbean Sea, near Greytown, on a sandy uninhabited coast, without harbor or shelter from the elements, with no means of communication along the line of the canal except through tortuous and much obstructed streams, some of which could not float a loaded canoe, and depending altogether on a base of supplies for materials for construction and subsistence 2,000 miles distant, with only one line of steamers touching on that coast, and two weeks distant from the nearest telegraph station.

The first work of the pioneers of the great enterprise was necessarily one of self preservation. Rude temporary shelters had to be improvised for the protection of men and stores while more permanent buildings could be erected; means of transportation along the route of the canal through deep and extensive swamps and virgin forests had to be provided for, and telegraph communication to the nearest station, more than one hundred miles from the coast, and connecting the various camps about to be established with the base of operations, was felt from the start to be an indispensable adjunct in prosecuting the work. Under these conditions, aggravated by an insufficient supply of an inferior class of labor, the first operations were difficult, tedious, and expensive, and it was not until the month of October following that the most indispensable elements for the organization of the various departments and distribution of the working forces had been created and the preliminary work of construction could be said to have commenced.

The opening of an entrance into what used to be the Bay of Greytown, now converted into a fresh-water lagoon, was recognized from the start to be an indispensable requisite in the prosecution of the work of excavating the canal. Ships now anchor about 2 miles off shore, and machinery and other supplies are brought ashore in lighters, through a shifting entrance and dangerous bar with a variable depth, never exceeding 6 feet. This method of landing supplies involves considerable risk and expense, and is altogether inadequate for the discharge of the heavy machinery required.

The company, therefore, has spared no effort in obtaining an entrance from the sea into the bay, and the construction of the breakwater required to arrest the shifting sand and protect the dredged channel was one of the first works undertaken by the company, and pushed ahead with all possible dispatch. This pier is now about 700 feet long, its outer end being in 12 feet of water, and so far has fulfilled, even beyond expectations, all that was expected to be accomplished by its construction. It affords now sufficient protection to the dredges excavating the channel, and the company has already made a contract for the excavation of the entrance and inner bay to a depth of 20 feet. Some of the dredges are on the way to Nicaragua and others are in process of construction and will soon leave for Greytown. It is expected, therefore, that within the next five months vessels drawing 15 or 20 feet may be able to enter the bay and discharge their freight directly on the wharves of the company.

Heavy machinery suitable for the work can then be safely landed, the work of preparation may be said to have been completed, and active operations can be undertaken along the whole route.

While prosecuting the harbor work the company has also established permanent quarters, erected large store-houses, hospitals, dwellings, shops, and other buildings. It has accumulated the necessary material for the construction of an aqueduct 13 miles in length (work on which is now actively pushed), which is to supply Greytown, the works on the eastern section of the canal, the harbor, and the company's headquarters with fresh water from the mountains. It has erected wharves and warehouses for the receipt and storage of supplies. Parts of the San Juanilio, Deseado, San Francisco, and other streams have been cleared of obstructions and made navigable for small crafts, and several miles of the route of the canal between the harbor and lock No. 1 have been grubbed and cleared and made ready for dredging.

The company has built about 2 miles of broad-gauge railroad and about 70 miles of telegraph and telephone lines, and has landed at Greytown large quantities of machinery, tools, lumber, piles, creosoted timber, boats, steam-tugs, and launches, lighters, pile-drivers, and other materials and equipment necessary for the harbor and canal work. Large quantities of railroad supplies, locomotives, and steam excavators are now at Greytown, and a contract has been let for the construction of 17 miles of railroad from Greytown to the eastern divide cut, work on which has already been commenced. The company has also spent large sums of money for engineering work in locating railroads and in making final plans and detailed surveys of the canal, the harbors, locks, and other accessory works, and, in short, it may be safely said that the whole work is being pushed forward as rapidly as the circumstances and condition of the country permit.

There are now six engineering parties in the field, in addition to those engaged in the harbor and railroad construction, making detailed surveys and geological examinations of the sites of the dams and embankments and of the locks; so that the company may be able at any time to let the contract for those works simultaneously with that of excavating the canal.

The administration and medical departments as now organized and equipped are capable of rapid enlargement and efficient work, and there is every reason to believe that if the work on construction is prosecuted without interruption the canal will be opened to traffic within the six years intimated for its construction.

Q. How many years ago were you first there?—A. My first trip to Nicaragua was in March, 1872.

Q. How many times have you been there since; in how many different years?—A. 1872, '73, '74, '76, '77, '80, '85, '87, '89, and '90. That is the number of trips I have made.

Q. In all that time how many months altogether, in round numbers, have you spent there?—A. It may be estimated that I have been there no less than four and a half years' time continuously.

Q. Have you been there, taking it all things together, in all seasons of the year?—A. In all seasons of the year.

Q. How was your health affected by it?—A. It was always better. I have never been injuriously affected by the climate.

Q. What has been your observation, then, as to the Northern people and others you have employed, as to the salubrity of that climate?—A. In these expeditions in which I have been engaged, in the surveys both of the east and the west side, I have always had a large number of employés, most all Americans, with perhaps a dozen natives in each party, engaged in cutting brush and clearing the way for the engineers, and we have never lost a man, or I never had a man more than two days in camp on account of diseases contracted in the country.

Q. What do you think, then, in respect of any extraordinary danger to Northern white men in carrying on the operations of that canal?—A. I anticipate no danger whatever. So strong is this feeling that I have two of my sons there now engaged in the construction of the work.

Q. How much is the rise and fall of Lake Nicaragua in its present natural condition from extreme high water to extreme low water?—A. From 2½ to 5 feet. We propose to retain the level of the lake at 110 feet.

Q. How much will that swell it above its lowest natural condition?—A. Six and a half feet.

Q. So that that will carry it up to a height of 2 or 3 feet above its ordinary tide-water?—A. Yes, but 110 feet is not above the highest water-mark by any means.

Q. Will it carry it up where it will kill trees, make the shores as an overflowed land that is never now covered?—A. No, sir. I would not say never, for sometimes the water reaches an elevation above 112 feet.

Q. So that your highest point of elevation artificially made will not exceed what sometimes the highest natural water is?—A. No, sir.

Mr. MILLER. I have an idea that it has been over 112 feet.

Mr. MENOCAL. Yes.

By Senator EDMUNDS:

Q. What is the nature of the country there as to dry land or swamp?

—A. On the south side it is swampy. The west coast is solid land. The extreme northern end is swampy for a very short distance and on the east side is solid elevated land.

Q. So that really the only swampy shores are near the outlet at the very head?—A. Yes, that is just it, and where Lake Managua enters and empties into Lake Nicaragua. There is a kind of a low-land there.

Q. How many square miles of that low-land is there where the outlet of Lake Managua is?—A. I would not like to state.

Q. Oh, state in round numbers what you think.—A. Well, I think 15 or 20 miles.

Q. Fifteen or 20 square miles?—A. Yes.

Q. How much of the low end or south end of the lake—how far on either side is it swamp?—A. Well, the south end I never visited. On the north side there would be no inundation; on the east side near the outlet it may be a half a mile to 2 miles. It is flooded, however, in the rainy season.

Q. So that your permanent elevation, 110 feet, raising the water 3 or 4 feet above its present point, would not materially affect the surrounding country?—A. On the contrary, I think it would be healthy, for the reason that these low lands would be permanently covered, instead of being alternately covered wet and dry as now.

Q. What, in your opinion, is the most difficult engineering, practical problem as to an effective canal there?—A. I do not know that there is anything very difficult. I do not see any serious difficulty on the whole route.

Q. Yes, but you have spoken of the engineering difficulties being now practically solved, but referring to them as some being greater than others.—A. Well, there are some difficulties that have to be overcome.

Q. Where is the greatest difficulty?—A. The greatest difficulties I should say are in the constrction of the dam across the river San Juan and the construction of certain dams and embankments upon the San Francisco Valley.

Q. Is that San Francisco, containing a part of the water that comes out of the lake, a separate and independent river?—A. No, sir; it is a valley intended to be closed by dams and embankments and converted into a lake, and there is another valley here emptying through a narrow gorge into the broad valley of the San Juan, and that is also closed. Now these two valleys are separated by a ridge through which is cut a canal. Consequently you have so many miles of canal navigation through this deep basin without any excavation, except what is required to combine or connect these two valleys. Now, in raising the waters by the construction of the dam across the San Juan 55 feet the upper part of the river is converted into an extension of the lake, and that same level is continued through these different valleys and through the deep cut and beyond through a basin 5 miles long towards the Atlantic and east of the deep cut, made in the same way by the construction of another dam. Consequently the summit level extends from the easterly end of this latter basin to the westerly end of the Tola basin, west of the lake.

Q. That is, it extends how many miles from the Atlantic?—A. From within 12 miles of the Atlantic to 3 miles of the Pacific.

Q. You get the lake-level that whole distance?—A. Yes. It is not quite the lake-level. We call it level for all practical purposes of navigation, but of course the river San Juan must have a fall, and that fall is estimated at three-fourths of an inch to the mile, or about 4 feet for the 64½ miles of slack-water navigation.

Q. But between those two points there are no locks at all?—A. No locks; no, sir.

Q. Now you have spoken of the San Francisco River and of these basins that you make towards the Atlantic from this big dam?—A. Yes.

Q. Now, where does the water come from, from which you make these lakes?—A. It comes from tributaries of the San Juan.

Q. How are those dams here towards the Atlantic to affect, by making permanent water in those valleys, the health of that region, and how much of the flow that is not necessary for the purposes of canal navigation?—A. It will make the region healthy because it will flood all the lowlands and the water will come to the slope of these steep hills on the sides of the valley.

Q. Take the valley of the San Francisco, which you have spoken of as a tributary of the San Juan—you are building your dams there—how far up the valley of the San Francisco will that water-level go?—A. It will go for about 6 or 7 miles beyond the axis of the canal, and in a valley, almost a level plain.

Q. How wide is that plain?—A. About 6 miles in width and about 5 miles in breadth.

Q. What is this plain now that is to be flooded; are farms and people there?—A. No, sir; not at all. It is most all swampy.

Q. Heavy swamp forests?—A. Yes, enormous forests.

Q. What kind of timber?—A. Well, the timber resembles very much the white oak of this country.

Q. Very large trees?—A. Very large trees, and generally heavy timber, but not very good for construction purposes.

Q. Well, that flow going there permanently will destroy all that?—A. Yes.

Q. And in the end it will be a sheet of open water?—A. Yes.

Q. Which will be in the San Francisco 5 or 6 miles long and 6 or 8 wide?—A. Yes, I have estimated about 3,000 feet of grubbing and clearing as sufficient for the free navigation and anchorage of ships.

Q. Now, as to these artificial lakes that we are speaking of of the San Francisco Valley, are they supplied solely by the waters of the San Francisco River?—A. They are supplied solely by it; yes.

Q. Suppose the San Francisco River does not furnish sufficient water?—A. The basins will be supplied from the San Juan River.

Q. Then they would be supplied besides what the San Francisco furnished from the lake above and the river?—A. Yes.

Q. Now, with that area of surface in this San Francisco Valley is your canal, after evaporation, etc., going to be large enough to keep the level up there without having a tremendous current through it?—A. Yes, sir.

Q. Have you calculated all that?—A. Yes; the current in the canal will never exceed half a mile an hour. The size of the canal will be so proportioned that the current will be small.

Q. What is the dry season of the year there?—A. On the west side it is from November to May.

Q. On the east side, of which we are now speaking?—A. Well, there is no dry season except, perhaps, January to May, but it is not a dry season as it is on the west side, because it rains more or less on the east side at all times of the year.

Q. What is the average rain-fall during the year on the east side?—A. I should say that it is not less than 150 inches.

Q. And falling more or less every month of the year?—A. Yes, distributed through the whole year.

Q. Now take the San Francisco of which we have spoken, and does it not happen that sometimes there is a tremendous flood there?—A. Not a tremendous flood, because the water-shed of the San Francisco Valley is only 85 square miles, and sufficient waste-weirs have been provided for the discharge of the surplus waters.

Q. So you think that in the most tremendous storms that this artificial lake that you are to construct, taking in the San Francisco valley would not get so high as to disturb the canal operations? A. No, sir not at all. The water is always kept about the same level. As soon as the water rises it flows over these spillways [indicating] and is discharged over here.

Q. Since you have been there, in all these years have you had or known of any accurate observations made of the state of the water in the San Juan as regards its rise and fall from day to day?—A. No, sir; not continuous observations. We had observations from 1887 to 1888, showing the rise and fall of the river, but it has not been kept since.

Q. How much did it show that time?—A. We have had rises there of 12 feet.

Q. How would a rise of 12 feet affect your canal operations?—A. Well, it may raise the water in this portion of the canal extending from above the dam to lock number three, on the east side, probably 1½ feet to 3 feet, no more, because we have waste-weirs to provide for these sudden rises of the San Juan River.

Q. But where the river at the utmost has risen according to the observations taken you say the lake itself has only risen 5 or 6 feet?—A. Yes; because there is at present a fall of about 45 or 50 feet in that portion of the river.

Q. How far inland from your harbor at Greytown is this first dam to be built?—A. It is 32 miles.

Q. Now that is your lowest dam on the San Juan?—A. Yes, sir; that is the only dam in that river.

Q. What is the nature of each shore at that place where you propose to build that dam, I mean its geological and topographical formation?—A. The top is red clay, below is rock, and the bottom of the river is either rock or very compact gravel.

Q. What is the width of the river there from shore to shore?—A. At the present time, 900 feet.

Q. What is its depth where you propose to have the dam?—A. The maximum depth is 14 feet near the right bank, gradually decreasing to about a foot and a half at the other bank.

Q. No rock there?—A. There is rock projecting out on both banks from the abutments of the dam.

Q. That appear above the surface now?—A. Yes.

Q. So that you have a secure termination at either end of the dam?—A. Yes.

Q. What kind of a dam do you propose to build there?—A. I have proposed to build a rock-fill dam; that is, a dam made of rock dumped in the river and allow it to take its natural slope. The work of distributing the material will be done by the force of the water and its scouring action on the bottom until the proper equilibrium is established. In this way I expect that the company would have a very cheap and safe dam.

Q. Well, having got your rocks in in that way, how can you make a dam tight?—A. We have so much surplus water that I do not think we will make any efforts to make the dam tight, but if it was required to make it tight, all we have to do is to make a deposit of sand, clay, and other material on the upper slope of the dam.

Q. Do I understand you to mean by a rock-fill dam that way that you merely dump rocks right across; tumble them right in?—A. Yes, rocks weighing a ton or more.

Q. Precisely; but in respect to a structure, ashler or joints, or anything of that kind, you do not do it?—A. No, sir; that I would not regard safe. I regard this as entirely safe.

Q. And you expect to put the rocks in close enough together to produce the elevation you require?—A. We can do that by means of the wire-rope system.

Q. You then there really make a little cataract of bowlders that you put in?—A. That is so.

Q. Is that so of all your other dams?—A. All are expected to be made the same way.

Q. So that, as regards the construction of what in New England we would call a dam of the component and jointed work there of timber or stone there is nothing of the kind required.—A. Nothing at all. I had originally proposed to have these dams built of concrete and ashler, but afterwards I came to the conclusion that this was the safest dam, one that can not be carried away by floods nor affected by earthquakes, which, if anything, would make it more compact. Suppose we had a tremendous storm and extraordinary flood, it might carry a few rocks from the top away, but the rocks won't float; they must lay somewhere on the lower slope. The top of the dam might be lowered a few feet, but the main body of the dam will remain intact and we could repair the damage done by dumping more rock on the crest.

Mr. MILLER. It is simply an immense weight.

Mr. MENOCAL. It is an artificial mountain across the river.

By Senator EDMUNDS.

Q. The dam he proposes is what nature has done in a good many other places. You have spoken of earthquakes, which is an interesting subject to a good many people as regards the stability of such work. You have been down there a good many years, how many earthquakes have you experienced?—A. I never experienced but one or two, and they were so slight as to be of no consequence.

Q. How recent in history has there been any earthquake in that region of country that has overthrown houses, etc.?—A. Not any that I know of, except that the tower of a church and some houses have been slightly cracked.

Q. How long ago were these?—A. In 1845, in the town of Rivas, the church steeple fell.

Q. Where is that?—A. Rivas is about 3 or 4 miles from the line of the canal west of the lake.

Q. How long do you estimate the time that will be necessarily occupied in completing, with adequate funds, the canal?—A. I think one year for preliminary operations and six years, hard work will be sufficient to complete the work.

Q. So that, adequate funds and management being provided, you think it would be safe to say that the canal would be completely done and ready for occupation in eight years, making due allowance for contingencies?—A. Yes.

Q. So that you feel confident that within this century, which is ten years, with adequate funds and management, it would be a moral certainty that the canal would be in operation. Now, tell me about the nature of the country between the northwest side of the lake down to Brito; it is within only about 12 miles from the Pacific, and a descent in round numbers of 110 feet?—A. The country is comparatively a level country, what you might call a slightly rolling country, and it is most all open to cultivation. It is very fertile.

Q. Inhabited?—A. Inhabited, with fair roads for carts.

Q. And ranches, haciendas, and what we call farms, and all that sort of thing?—A. Very beautiful, yes.

Q. Well, does the canal open on some valleys, or is it a direct cut?—A. It goes from valley to valley. It goes from the valley of the river Lajas, which empties into the lake, into another valley of smaller size, and then after crossing the divide into the valley of the Rio Grande where an artificial basin is to be made, and from there to the Pacific it might be said it follows the valley of the Rio Grande.

Q. Now beginning at the lake, how far, following the canal line, is it to the absolutely highest point of the crest of the divide as nature now is?—A. It is 7 miles.

Q. There, then, on that side would be your deepest cut?—A. Yes.

Q. What would be the depth of that cut?—A. Seventy-two feet to the bottom of the canal.

Q. And how long?—A. That depth would be only at one point.

Q. Well say take it for 2 miles?—A. That deep cut is altogether 9 miles long.

Q. What would be the average depth of that?—A. I should say the average depth is about 18 feet above water level.

Q. What sort of material?—A. The material is mostly of rock, covered by 10 or 15 feet of clay or gravel.

Q. Then you would have on an average of about how much depth of rock cutting for that 9 miles?—A. The rock cutting would be about 35 to 40, average.

Q. What is the nature of that rock?—A. It is trap-rock. It is a volcanic rock, easily blasted, and at the same time very good for construction purposes.

Q. Capable of resisting water so it can be used for construction?—A. Yes. It is very well adapted for concrete work.

Q. Does it come out in forms capable of using for masonry?—A. It is strong enough, but very difficult to cut. It is very hard to be cut and dressed. We use it in concrete.

Q. Then you expect to feed your western canal from the lake itself?—A. Yes.

Q. But you have three locks?—A. Three locks; yes, sir.

Q. And they are to cover altogether 110 feet rise?—A. Yes. There will be two locks with 85 feet, 42½ feet to the lock.

Q. That is a tremendous pressure. Those locks you would have to build of good masonry?—A. No; I propose to build them of concrete.

Q. By concrete you mean to take this stone that comes out of your rock cutting for your stone, and then you break that up into pieces of what average size?—A. Not more than 3 inches.

Q. And then you put that in with cement?—A. Cement and sand mixed into mortar, and then ram it in layers.

Q. Have you got any drawings or anything now that would show your proposed method of the construction of those locks?—A. My report is complete so far as a report of that kind can be. It does not contain the specifications of every piece of work, as that would make it too voluminous, but contains a general description of the works.

Q. Tell me in a general way, now, as to the strength of these locks. You have one that has a head of 42½ feet, and you are going to make that dam, as I will call it, at the foot of the lake?—A. Gates.

Q. Not only gates, but you have got to have side walls and one thing or another. Now, then, to make this part of the work that has got to stand the pressure of 42½ feet head of water, what would be the size of a cross-section of your concrete?—A. That depends a good deal on what is back of the concrete. We always try to get a hill for the excavation of a lock. If the excavation is rock you will understand it does not require very much masonry wall, because the rock itself back of the concrete will hold it. On the other hand, if we have softer material then you will have to proportion the concrete to the material backing the wall.

Q. That is to say, you undertake to fortify all the lower side with concrete?—A. Yes.

Q. Do you mean you are going to make your lock, like Sault Ste. Marie, for instance, all concrete?—A. All concrete lined with timber.

Q. So that the whole stone structure will be concrete?—A. Yes.

Q. Just a simple mass of homogeneous concrete?—A. Yes.

Q. Without any joints or anything else?—A. Yes.

Q. What is the nature of the bottom there where you have the foundation?—A. Rock. Most all excavation for locks will be in rock, so much so that we expect to save a good deal by cutting the lock into the solid rock and then line the excavation with large timber.

Q. So that you think the mechanical problem of resisting the pressure of the weight of water by this concrete work instead of the enormous masonry we have in locks north can be entirely overcome? A. Yes.

Q. Well, when you have got down then to the sea-level at Brito, what sort of a harbor, or what is the contour of land there; what have you to do on the Brito side to make shelter for vessels?—A. On the Brito side we have practically to build a harbor. I would not say we have to improve what we have, but practically we have to build one, but the physical conditions are favorable for the construction of this harbor.

Q. Have you a plan of the harbor?—A. I have not with me, but will send it to you with pleasure.

Q. I wish you would do so.—A. Now, I will explain this [indicating on map]. This is the Brito side. The coast comes just on the edge of that dark spot. What we propose to excavate is either side of the high-water mark. This is the high-water mark. We propose to dredge all this out in order to make a harbor. Now the coast goes this way, and then there is a promontory or projection that extends to deep water. We propose to build a breakwater where you see it indicated here, and another one here, and then dredge from a point outside of the harbor, which will be here.

Q. Now, taking the coast line of Brito as it is now where you intend to make your harbor, what is the rise and fall of the tide there?

Q. Now, at low water, how far out from the present contour of the shore where you are to go into the land with your canal must you go in order to get 30 feet of water?—A. How much out at sea?

Q. Out at sea?—A. I should say about 1,500 feet.

Q. Is that a coast of rather a straight line?—A. Yes; rather a straight line.

Q. How are you to protect it then from storms?—A. By the construction of these two breakwaters, which will be built from the rocks coming out from the divide cut.

Q. What kind of a breakwater do you propose to build there?—A. Riprap, out of large stones, just the same as the Holyhead breakwater.

Q. Not like the breakwater out from Amsterdam to the North Sea, which, I believe, is built of great rocks in tubes and laid up?—A. No.

Q. Do you know how that North Sea breakwater has stood the elements? I saw it, when it was just about being completed, in 1879.—A. It has stood very well, but it is a very expensive work. The Holyhead breakwater is built of riprap and is doing its work just as well. In this case we have a certain amount of rock we have to dispose of, and we have no other use for it except the construction of such breakwater and of locks and dams, and the balance must be disposed of by dumping on the poil banks.

Q. What is the length of these contemplated breakwaters?—A. One is 900 feet long, extending to 40 feet depth of water, and the other is between 500 and 600 feet. The object of the latter is merely to narrow the entrance so that the swell will produce no disturbance in the harbor.

Q. How far apart will the head of the two breakwaters be?—A. Six hundred feet.

Q. And in a right line from the end of each one of those breakwaters to the land part of the canal as it comes in would be how far?—A. That would be some 3,000 feet.

Q. Would that make a harbor long enough in heavy weather for a vessel to run in and round to and come to anchor?—A. Well, some vessels have to be careful in doing so, and it will always be safer in bad weather to tow in sailing vessels.

Q. In what direction do these storms come on that coast of Brito?—A. They generally come from the southwest. I have submitted this plan of the harbor to the Navy Department, and they approve it and think it very good. The storms come from the southwest and the harbor will be protected, and the breakwaters are so placed that a heavy sea, after passing the outer end of one breakwater, will not go into the harbor, but pass beyond the end of the other breakwater.

Q. What are the natural resources of that country within 100 miles on either side of this canal and lake?—A. Principally cattle raising, coffee, indigo, sugar-cane, beans, rice, plantains, bananas, and all tropical fruits.

Q. How much do you suppose, as a mere round estimate, population there is within two parallel lines, each drawn 100 miles away on either side of the line of your canal from sea to sea, making a cross-section of 200 miles in a straight course of 125 miles, or whatever it may be across there?—A. I should say 250,000.

Q. A sparse population, then?—A. Very much so.

Q. Well, the parts of that section that I have now assumed to give a description of that are not occupied by cultivation and clearage. What sort of forests are there; any valuable timber of any kind?—A. Very valuable. It depends upon what side of the lake you are on. On the west side there is very valuable timber. Mahogany, rose-wood, ebony, and all kinds of timber for construction, very valuable; while on the east side the timber is generally soft, heavy, and not suitable for permanent construction.

Q. Of no particular value, then, for purposes of utility or commerce for exportation?—A. No, sir.

Q. The only resources of the country, then, would be those that come from the cultivation of the soil?—A. The cultivation of the soil and mines.

Q. Are there mines there?—A. Yes, silver and gold mines.

Q. Any coal?—A. Coal has been found recently and excavations are now being made to see to what amount it can be obtained.

Q. Is what they think they have found anthracite or bituminous?—A. Bituminous.

Q. Any iron?—A. No, sir.

Q. Any copper?—A. No, sir.

Q. So that, as far as known, the only value in ore is gold and silver?—A. Gold and silver.

Q. No cinnabar?—A. No, sir.

Q. Are there any fine qualities of stone there—marbles or granite?—A. No, sir.

Q. All the rock is volcanic of one form or another?—A. All volcanic.

The committee adjourned.

SENATE OF THE UNITED STATES,
COMMITTEE ON FOREIGN RELATIONS,
Thursday, June 5, 1890.

The subcommittee met at 10.30 a. m. Present, Senators Edmunds (chairman), Dolph, and Payne.

STATEMENT OF HIRAM HITCHCOCK.

By Senator EDMUNDS:

Q. Please state your full name and residence?—A. Hiram Hitchcock, Fifth Avenue Hotel, New York.

Q. You are president of the Maritime Canal Company of Nicaragua, chartered by Congress?—A. Yes, sir.

Q. How long have you been president?—A. Since its organization, May 4, 1889.

Q. Who were the people who participated in the organization of the company, if you have any papers to show?—A. The incorporators named in the charter took part in the organization.

Q. All of them?—A. Not all of them, but about two-thirds of them, and the following committee was appointed at the meeting of the incorporators to act as a committee of five under said charter to open books of subscription to the capital stock: Hiram Hitchcock, Horace L. Hotchkiss, Francis A. Stout, R. A. Lancaster, and A. C. Cheney.

Q. What is that paper you have in your hand?—A. This is the first annual report which the company has to make to the Government of the United States under the terms of the charter, and which was made last December.

Q. That is a copy of it?—A. Yes, sir.

Q. Have you one to spare?—A. I brought it for the committee.

The report is as follows:

REPORT OF THE MARITIME CANAL COMPANY OF NICARAGUA.

To the honorable Secretary of the Interior:

Pursuant to section six of the act of Congress entitled "An act to incorporate The Maritime Canal Company of Nicaragua," approved February 20th, 1889, which provides that said company shall make a report on the first Monday of December in each year to the Secretary of the Interior, and in accordance with the instructions received from you prescribing the form of such report and the particulars to be given thereby, and by the express authority of the said company, we, the undersigned, Hiram Hitchcock, president, and Thomas B. Atkins, secretary of the said The Maritime Canal Company of Nicaragua, do hereby make the following report on behalf of the said company, and do certify and declare as follows:

First. That a meeting of the incorporation named in the said act of Congress was held on the seventh day of March, 1889, pursuant to call, at No. 36 Wall street, in the city of New York, when the charter granted by Congress was unanimously accepted, and a communication to that effect forwarded to the Secretary of State. That at the same meeting Messrs. Hiram Hitchcock, Horace L. Hotchkiss, Francis A. Stout, R. A. Lancaster, and A. C. Cheney were chosen by a majority of the number from those named in the aforesaid act as the five incorporators empowered by said charter to open books of subscription to the capital stock of the company and to receive subscriptions for the same.

Second. That the said committee of incorporators gave thirty days' notice of the time and place of the opening of the books of subscription to the capital stock of the said company by publication in one daily newspaper in New York City and one newspaper in Managua, Nicaragua, and one in San José, Costa Rica, and that, pursuant to such notice, the said books of subscription were duly opened, on the 22nd day of April, 1889, at No. 44 Broadway, in the city of New York.

Third. That a meeting of the subscribers to the said capital stock was held on the second day of May, 1889, pursuant to notice, at number 44 Wall street, in the city of

New York, and at such meeting the following board of fifteen directors was duly elected by the stockholders of said company in the manner provided for in the said act of incorporation, to serve for the periods set opposite their respective names, to wit:

Charles P. Daly, Frederick Billings, Daniel Ammen, Horace L. Hotchkiss, Joseph E. MacDonald, to serve for three years.

Francis A. Stout, Alfred B. Darling, Franklin Fairbanks, C. Ridgeley Goodwin, Alexander T. Mason, to serve for two years.

Joseph Bryan, James Roosevelt, Hiram Hitchcock, Horatio Guzman, Pedro Perez Zeledon, to serve for one year.

That a majority of the above-named directors are citizens and residents of the United States, and that all of them are stockholders in the Maritime Canal Company of Nicaragua.

Fourth. That on the fourth day of May, 1889, a meeting of the directors, elected as aforesaid, was held pursuant to notice, at number 44 Wall street, in the city of New York, and at such meeting by-laws were adopted, and the following officers were elected for the ensuing year, to wit:

President, Hiram Hitchcock.

Vice-President, Charles P. Daly.

Secretary and treasurer, Thomas B. Atkins.

That all of the officers so elected are citizens and residents of the United States.

Fifth. That in accordance with the provisions of said act of incorporation, the principal office of The Maritime Canal Company of Nicaragua has been established in the city of New York, at No. 44 Wall street.

Sixth. That The Maritime Canal Company of Nicaragua has completed the axial surveys and final plans of the proposed interoceanic canal, and the same have been officially approved by the Government of Nicaragua. That on the third day of June, 1889, the company began the preliminary work of construction at Greytown, and on the 8th day of October following commenced the work of excavation. That the Government of the Republic of Nicaragua has officially recognized and declared by decree that the construction of the canal was formally commenced, in accordance with the terms of the concession, on the said 8th day of October, 1889.

That since the said 3d day of June, 1889, the company has established permanent headquarters at Greytown, erected store-houses, hospitals, dwellings, and other buildings, constructed several miles of aqueduct, cleared parts of the San Juan and Deseado Rivers, laid several miles of broad-gauge railroad, constructed about thirty-five miles of telegraph line, and cleared the first part of the route of the canal. That it has shipped to Greytown and landed at that port large quantities of machinery, tools, lumber, piles, boats, and other materials necessary for the establishment of the plant to be used in the construction of the said canal. That, in addition to the above, the company has organized in Nicaragua a complete hospital service and ambulance corps, and has perfected the sanitary arrangements in and about its camps and headquarters.

Seventh. That during the coming winter the work of railroad and telegraphic construction will be continued and prosecuted with energy, the building of a breakwater for the Atlantic port of the canal will be commenced, and the dredging work will be pushed forward with all possible dispatch. That several large dredges have recently been contracted for, and other contracts relating to the construction of the canal are now in course of negotiation with responsible contractors, and it is expected they will be closed at an early date.

Eighth. That ten thousand one hundred and forty-five shares of the capital stock of The Maritime Canal Company of Nicaragua have already been subscribed at par, amounting in the aggregate to the sum of one million fourteen thousand five hundred dollars ($1,014,500), of which amount six hundred and one thousand four hundred and fifty ($601,450) dollars have been paid into the treasury of the company in cash. That the other assets of the company consist at present of the property, rights, privileges, and franchises now owned by it in Nicaragua and New York.

Ninth. That since the third day of June, 1889, the company has expended upon the work carried on in Nicaragua more than five hundred thousand ($500,000) dollars, and that its liabilities, which consist chiefly of expenditures incurred during the month of November, do not exceed the sum of fifty thousand ($50,000) dollars.

Tenth. That the details of the work to be done on the canal are briefly as follows: The construction of a breakwater at or near Greytown on the Caribbean Sea, and dredging thence to the westward ten miles through alluvial ground to the place where a lock of thirty-one feet lift will be built. At two miles beyond will be constructed a second lock or double lock of the combined lift of seventy-five feet, and a dam across the small stream Deseado, above which will be a basin affording four and one-quarter miles of free navigation; then a rock cut about two and three-quarter miles in length, followed by twelve miles of free navigation in the valleys of two small rivers, the San Francisco and the Machado. Here the waters will be raised by *dams and embankments* so as to form basins, which will connect directly with the

San Juan River above a large dam to be built across that river. Said dam will raise the waters in the river and lake and secure additional free navigation of sixty-four miles in the river and fifty-six and one-half miles across the lake. On the western side of the lake the canal will enter a cut of slight depth in the earth and rock of nine miles in length, issuing thence into the Tola basin, with five and one-half miles of free navigation, which will be obtained by damming the Rio Grande. At this dam a series of locks will lower the level eighty-five feet, and the canal will proceed in excavation down the valley of the Rio Grande a distance of two miles to the last lock, a tidal lock of twenty to thirty feet lift, below which the canal will enter the upper portion of the harbor of Brito, one and one-half miles from the Pacific.

In witness whereof we have hereunto set our hands this second day of December, in the year of our Lord one thousand eight hundred and eighty-nine, and affixed hereto the corporate seal of said company.

HIRAM HITCHCOCK,
President.

[Seal of Maritime Canal Company of Nicaragua.]

THOS. B. ATKINS,
Secretary.

STATE OF NEW YORK,
City and County of New York, ss:

Hiram Hitchcock, being duly sworn, says: That he is the president of said The Maritime Canal Company of Nicaragua; that he has read the foregoing annual report and knows the contents thereof, and that the same is in all respects correct and true.

HIRAM HITCHCOCK,
President.

Sworn to before me this 2nd day of December, 1889.
[Notarial seal.]

NESTOR PONCE DE LEON,
Notary Public, N. Y. C., 25.

STATE OF NEW YORK,
City and County of New York, ss:

Thomas B. Atkins, being duly sworn, says: That he is the secretary of said the Maritime Canal Company of Nicaragua; that he has read the foregoing annual report and knows the contents thereof, and that the same is in all respects correct and true.

THOS. B. ATKINS.

Sworn to before me this 2nd day of December, 1889.
[Notarial seal.]

NESTOR PONCE DE LEON,
Notary Public, N. Y. C., 22.

STATE OF NEW YORK,
City and County of New York, ss:

On the second day of December, in the year 1889, before me personally came Thomas B. Atkins, known to me to be the secretary of the Maritime Canal Company of Nicaragua, and with whom I am personally acquainted, who, being by me duly sworn, did depose and say: That he resided in the city of New York; that he was the secretary of The Maritime Canal Company of Nicaragua; that he knew the corporate seal of said company; that the seal affixed to the foregoing report was such corporate seal; that it was so affixed by order of the board of directors of the said company, and that he signed his name thereto by the like order as secretary of the said company.

And the said Thomas B. Atkins further said that he was acquainted with Hiram Hitchcock and knew him to be the president of said company; that the signature of the said Hiram Hitchcock subscribed to the said instrument was in the genuine handwriting of the said Hiram Hitchcock, and was thereto subscribed by the like order of the said board of directors, and in the presence of him the said Thomas B. Atkins.

In witness whereof I have hereunto set my hand and official seal this second day of December, A. D. 1889.
[Notarial seal.]

NESTOR PONCE DE LEON,
Notary Public, N. Y. C., 25.

Q. This report shows the proceedings down to the time it was made?—A. Yes. If you will allow me to say further, that committee opened the books and proceeded in accordance with the charter and a board of directors was elected, which organized and elected its officers May 4, 1889.

By Senator DOLPH:

Q. How much stock was subscribed?—A. There was subscribed at that time 145 shares, mainly by the different incorporators, for the purpose of organization; no other subscriptions were offered.

By Senator EDMUNDS:

Q. What was the par value of the shares?—A. One hundred dollars.

By Senator DOLPH:

Q. Does this report show the stockholders and the amount subscribed by each?—A. Not the individual names. I could have brought the detailed statement of the list of names, but the different incorporators subscribed for a few shares each for the purpose of effecting the organization of the company.

By Senator EDMUNDS:

Q. How much was subscribed down to the 2d of December?—A. In all 10,145 shares, and I have brought the certificate of the secretary of the company, showing the subscription down to the present time.

Q. Just read the certificate.—A. It is as follows:

> I, Thomas B. Atkins, secretary of the Maritime Canal Company of Nicaragua, hereby certify that the entire issue of the capital stock of the Maritime Canal Company of Nicaragua is 10,145 shares, all of which is now outstanding; and that of said issue 10,000 shares have been paid for in full in cash, and 145 shares have been paid for, 10 per centum thereof in cash, and 90 per centum thereof is payable at the option and upon the call of the company.
>
> In certification of which, witness my hand this 3d day of June, 1890.
>
> THOMAS B. ATKINS,
> *Secretary.*

By Senator DOLPH:

Q. You say you have nothing to show who are the present stockholders?—A. No, sir, I have not. I could have brought you that list. It includes the incorporators under the charter. I think they are all down for one or more shares. I can give you that list of names from a copy of the charter here if it is important.

By Senator EDMUNDS:

Q. No; we know who those are. We would like to have you send us a list of the names of all the present stockholders, and the number of shares standing to the credit of each.—A. I will do that. It is as follows:

List of shareholders of The Maritime Canal Company of Nicaragua, chartered by the United States of America:

	Shares.		Shares.
Charles P. Daly	5	J. E. McDonald	5
Henry R Hoyt	5	C. R. Goodwin	5
Robert Sturges	2	Frederick Billings	5
Alexander J. Mason	1	A. G. Menocal	5
F. A. Stout	5	R. A. Lancaster	5
H. L. Hotchkiss	5	Henry A. Parr	5
Henry C. Taylor	5	J. F. O'Shaughnessy	5
A. C. Cheney	5	H. Guzman	1
H. Hitchcock	5	Thomas B. Atkins	1
F. Fairbanks	5	C. H. Stebbins	5
A. B. Darling	5	J. Aldigé	5
James Roosevelt	5	C. Devries	5
Daniel Ammen	5	E. F. Beale	5
A. S. Crowninshield	5	Joseph Bryan	5
J. W. Miller	5	The Nicaragua Canal and Construction Company	10,000
F. F. Thompson	5		
G. H. Robinson	5		
G. E. Kissel	5	Total	10,145

I, Thomas B. Atkins, secretary of the Maritime Canal Company of Nicaragua, hereby certify that the foregoing is a correct list of the shareholders of the company and of their respective holdings as set opposite their respective names.

Witness my hand this 7th of June, 1890.

THOMAS B. ATKINS,
Secretary.

Q. Who is the secretary of your company?—A. Thomas B. Atkins.

Q. What is his address?—A. 44 Wall street.

Q. Who is the treasurer?—He is also the treasurer of the company. Here is a complete list of the directors and officers of the company. We had an annual meeting in May, 1890.

Directors for three years.—Joseph Bryan, James Roosevelt, Hiram Hitchcock, Horacio Guzman, Thomas B. Atkins.

Directors for two years.—Charles P. Daly, Frederick Billings, Daniel Ammen, Horace L. Hotchkiss, Joseph E. McDonald.

Directors for one year.—Francis A. Stout, Alfred B. Darling, Franklin Fairbanks, C. Ridgely Goodwin, Alexander T. Mason.

President, Hiram Hitchcock; vice-president, Charles P. Daly; secretary and treasurer, Thomas B. Atkins.

Executive committee: Frederick Billings (chairman), Charles P. Daly, Horace L. Hotchkiss, Alexander T. Mason, Hiram Hitchcock.

That is the list as it now stands. The only change from last year was the retirement of Mr. Zeledon, of Costa Rica, and the election of Mr. Atkins in his place.

By Senator DOLPH:

Q. Does your report to the Government show the financial condition of the treasury; does it contain a statement of the assets of the company at the time it was made?—A. The report to the Government, of which this is a copy, was made in December. It states the facts with reference to the organization and the subscription of stock and expenses and disbursements to that time. In February, before the year from the passage of the charter had expired, I also made a report to the Government, as required by the charter, that we had received more than $1,000,000 as payments on account of the stock of the company. I have here a statement for you of the financial status of the company at the present time, the treasurer's statement.

Q. Yes; that is what I was inquiring about.—A. I will read it.

I, Thomas B. Atkins, treasurer of the Maritime Canal Company of Nicaragua, hereby certify that I have received as treasurer of said company, during the year ending May 1, 1890, $1,001,450, all of which has been paid in on subscriptions to capital stock; of which amount I have disbursed for construction and other purposes during the year, $830,161.87, and have remaining, May 1, 1890, a balance in the treasury of $171,283.13.

In certification of which, witness my hand this 3d day of June, 1890.

THOMAS B. ATKINS,
Treasurer.

By Senator EDMUNDS:

Q. Now state in that connection what are the outstanding obligations of your company?—A. We have no outstanding obligations that are due. Our bills due are all paid. There may be, however, some small bills not yet audited. At the time this report was made, in December I think, there were about $50,000 of expenses that might be presented for payment.

By Senator DOLPH:

Q. And the $800,000 paid over to the construction company?—A. Yes.

Q. So that it was not disbursed by your company?—A. No, sir; but it has been disbursed, on vouchers by the construction company, for work done under their contract with us.

By Senator EDMUNDS:

Q. Well, when you paid over that $800,000, in round numbers, was that in advance or for work actually performed?—A. For work actually performed.

Q. Well, what funds are they working on now? I understand from Mr. Miller that the work is progressing in a diligent and satisfactory way.—A. They are going on with their own money, and as fast as they present us with proper vouchers for work, we must, in order to pay them, obtain money on stock subscription or on bonds.

Q. Now, what is the arrangement between your company and the construction company?—A. The arrangement is as follows, and I have brought a copy of the papers to leave with you. This is the provisional contract under which we were acting.

Q. The temporary contract.—A. Yes.

Mr. Hitchcock read the contract as follows:

I, Thomas B. Atkins, secretary of The Maritime Canal Company of Nicaragua, hereby certify, that on the 24th day of May, 1889, there was held at the office of the company, 44 Wall street, in the city of New York, a meeting of the executive committee of the board of directors of The Maritime Canal Company of Nicaragua, duly convened; that at said meeting there was presented a letter from The Nicaragua Canal Construction Company, of which a certified copy, marked Exhibit A, is hereto attached. That a reply thereto, of which a certified copy, marked Exhibit B, is hereto attached, was duly authorized, and that a second letter from The Nicaragua Canal Construction Company, of which a certified copy, marked Exhibit C, is hereto attached, was rereceived by said executive committee, was considered, and was ordered on file. In certification of all of which,

Witness my hand this 3d day of June, 1890.

THOMAS B. ATKINS,
Secretary.

EXHIBIT A.

OFFICE OF THE NICARAGUA CANAL CONSTRUCTION COMPANY,
44 *Wall Street, New York, May* 24, 1889.

THE MARITIME CANAL COMPANY OF NICARAGUA:

GENTLEMEN: The Nicaragua Canal Construction Company hereby offers to do the entire work of every kind and nature of constructing the interoceanic canal to be built by your company, and in accordance with the plans of A. G. Menocal, as approved on the 9th day of March, 1889, by the board of civil engineers to whom the same was submitted for examination, and also according to any modifications or changes that may hereafter be made in said plans which do not substantially vary from the general route as now laid down in Mr. Menocal's plans or increase the expenses of constructing the same, and to begin the work at once and to complete the same in all respects as required by the stipulations and conditions in the concessions held by your company, for the sum of $200,000,000 in the first mortgage bonds of your company and $75,000,000 of the capital stock, payments to be made in equal proportions of stock and bonds every thirty days for such portions of the work as the engineers of your company shall certify have been completed, the work to be begun at once.

As a guaranty of good faith this company hereby agrees to subscribe for $100,000,000 of the stock of your company, and to pay for the same in cash.

Yours very truly,

A. C. CHENEY,
President of the Nicaragua Canal Construction Company.

I, Thomas B. Atkins, secretary of the Maritime Canal Company of Nicaragua, hereby certify that the foregoing is a true and correct copy of a letter received May 24, 1889, by the Maritime Canal Company of Nicaragua from the Nicaragua Canal Construction Company.

Witness my hand this 3d day of June, 1890.

THOMAS B. ATKINS,
Secretary.

To that I made the following reply:

EXHIBIT B.

THE MARITIME CANAL COMPANY OF NICARAGUA,
44 *Wall Street, New York, May* 24, 1889.

To the NICARAGUA CANAL CONSTRUCTION COMPANY:

GENTLEMEN: Your offer to begin at once the construction of the Nicaragua Canal is at hand.

You are hereby authorized and directed to begin such construction work at the earliest possible moment, with this understanding and agreement: That, if within three months this company does not accept your proposition or execute a contract with your company that shall be mutually satisfactory, then, in such an event, this company will re-imburse your company for all the expenditures incurred in connection with the construction work and 10 per cent. in addition thereto.

Yours, very respectfully,

HIRAM HITCHCOCK,
President of the Maritime Canal Company of Nicaragua.

I, Thomas B. Atkins, secretary of the Maritime Canal Company of Nicaragua, hereby certify that the foregoing is a true and correct copy of a letter delivered by me May 24, 1889, to the president of the Nicaragua Canal Construction Company.

Witness my hand this 3d day of June, 1890.

THOMAS B. ATKINS,
Secretary.

That, of course, was because we could not make a large contract with any company at that point of time, and therefore we reserved the right to simply pay them for what they did and 10 per cent. additional.

Q. Well, that is within three months?—A. If we did not make a contract within three months. Well, we did not make a contract within three months.

Q. So that as the thing stood they were going on under this authority and you were either bound to make a contract that was mutually satisfactory or else you were bound to re-imburse them with 10 per cent., profit?—A. That is it exactly. To that they responded as follows:

EXHIBIT C.

OFFICE OF THE NICARAGUA CANAL CONSTRUCTION COMPANY,
44 *Wall Street, New York, May* 24, 1889.

HIRAM HITCHCOCK, Esq., *President of the Maritime Canal Company of Nicaragua:*

DEAR SIR: I beg to acknowledge receipt of your letter of the 24th instant, authorizing and directing this company to begin the construction of the Nicaragua Canal at the earliest possible moment, upon terms and conditions therein stated.

In reply, I beg to advise you that this company will, in compliance with your directions, commence the work of constructing the Nicaragua Canal at once; and to that end will dispatch an expedition to Nicaragua on the 25th instant.

Very respectfully, your obedient servant,

A. C. CHENEY,
President of the Nicaragua Canal Construction Company.

I, Thomas B. Atkins, secretary of the Maritime Canal Company of Nicaragua, hereby certify that the foregoing is a true and correct copy of a letter received May 24, 1889, by the Maritime Canal Company of Nicaragua, from the Nicaragua Canal Construction Company.

Witness my hand this 3d day of June, 1890.

THOMAS B. ATKINS,
Secretary.

That was the 25th of May a year ago. We regarded this as entirely sufficient for us because it left us perfectly free (without any obligation as to stock or bonds to any one) to pay them for what they had done and 10 per cent. and stop at any time.

Q. And take it off their hands?—A. Yes.

Q. Now, then, what further steps were taken?—A. They immediately sent out an expedition and work commenced there on the 3d of June. The progress of that work is fully stated in this report to the Government of the 1st of December and in this further report which includes everything down to the present time, and which is as follows:

> Since the commencement of operations in Nicaragua the company, with funds already obtained, has established a complete and perfect organization at Greytown, from which point active operations are being conducted, and has accomplished besides many other important works of installation and construction. The final plans and detailed surveys of the canal, its harbors, locks, and other accessory works, have been completed and verified, and large sums of money have been expended for engineering works in locating railroads, making rock borings at the divide and other places along the line of the canal, and in perfecting the location of the route from ocean to ocean. Permanent headquarters have been established at Greytown, large barracks, storehouses, hospitals, dwellings, and other buildings have been erected, and wharves and warehouses built for the receipt and storage of supplies. Parts of the San Juanillo, Deseado, San Francisco, and other navigable streams through which the canal will pass, have been cleared of obstructions to navigation, and several miles of the route of the canal between the harbor and lock number one have been grubbed and cleared and made ready for dredging. The company has built over a mile of broad-gauge railroad, constructed over 70 miles of telegraph and telephone lines, and has also landed at Greytown large quantities of machinery, tools, lumber, piles, creosoted timber, boats, steam launches, lighters, pile-drivers, and other materials and equipment necessary for work in restoring the harbor, and for use in the construction of the canal. It has built over 700 feet of the breakwater intended to protect the harbor entrance from the effects of shifting sand on the coast, and has also under construction an aqueduct 13 miles long, which is to supply Greytown and the company's headquarters with pure and fresh water from the mountains. Contracts have been let for dredging the bar and harbor, and for the building of 17 miles of railroad from Greytown to the divide, and work under the same will be commenced on May 15, 1890. Some of the dredges contracted for are now on their way to Nicaragua, while others are in course of construction. Large quantities of railroad supplies, locomotives, steam excavators, water piping, and other materials of construction necessary for the railroad, breakwater, aqueduct, and other works, are to be forwarded to Greytown every month, and, in short, the whole work is being pushed forward as rapidly as possible.

That is the report of the work. The work, of course, has been done by the Construction Company.

Q. How much has been expended in all, so far, in round numbers?—A. In all, I should say (I am not entirely familiar with the later details of expenditure, but I am tolerably well up in it), from first to last, about a million and a half has been expended. That of course includes the expenses from the beginning.

Q. Who is the secretary of that company?—A. Mr. Jacob W. Miller, who is the president of the Boston and New York (New London) Railway Company.

Q. Who is the treasurer?—A. Henry R. Hoyt.

By Senator DOLPH:

Q. How is it that the difference between the $800,000 paid out by your company and the million and a half has not been presented?—A. I stated this was from the beginning. Now in the first place the Nicaragua Canal Association was formed, and the Construction Company was its successor as to work of construction. The association expended a quarter of a million dollars before the Construction Company took hold, so that including that, and what the Construction Company has done, and done in advance of payment, I understand it is about a million and a half dollars.

Q. Do you pay interest on advances as the money is expended by the Construction Company?—A. No, sir; the contract does not call for it.

By Senator EDMUNDS:

Q. Are any of the officers of the Maritime Canal Company members of the Construction Company?—A. Not as officers; they are stockholders. The officers are entirely different.

Q. The management is entirely separate?—A. Entirely separate.

By Senator DOLPH:

Q. Can you state how nearly identical the stockholders of each company are?—A. Well, I should say all the stockholders of the Maritime Company are also stockholders of the Construction Company.

By Senator EDMUNDS:

Q. Are any of the stockholders of the Construction Company, aside from the ones you have named, stockholders in the Maritime Company?—A. No, sir.

Q. But the Construction Company itself is a stockholder to the extent of $1,000,000?—A. Yes; and the Construction Company has a large list of stockholders all over the country.

Q. Have you had any further transactions with the Construction Company looking to the future as to what sort of a permanent contract shall be made?—A. We have arranged and agreed upon the leading points of a permanent contract. The original draft of that contract I did not bring with me. The contract has never been signed because it is not quite complete. It can not be completed until we know a little more as to what our securities will bring in order to know how many securities to issue, and in order to fix a compensation in securities. All those questions will have to be settled before the contract can be fully completed. I have the synopsis of the contract here.

Q. Is there any point of difference between your company and the Nicaraguan Government now outstanding?—A. No, sir, there is no point of difference whatever. I may as well perhaps say, as you ask me the question, with reference to that, that there is no point of difference remaining unsettled between the company and Nicaragua at the present time. That leads me to say (without assuming to be able to give you gentlemen the least information on that point) that it is proper that you should know from us officially the relations which exist between us and Nicaragua, and in fact Central America generally. It is, as I said before, perhaps unnecessary to state these facts, but there are complicated questions. The rights to the San Juan River, the boundary questions between Nicaragua and Costa Rica, always come up when any question of transit across that Isthmus arises. You will find that under Tyler's administration, in 1842, this matter was somewhat considered by Mr. Webster, and it has been before every Secretary of State in some aspect from that time to this. It involves the canal question. Now the question of the respective rights in this particular route was supposed to have been settled under the treaty of limits between those two powers of 1858. Under that treaty, while Nicaragua owns the entire route, yet Costa Rica has the right to navigation and has the right to be consulted.

Now I come down to the point where it concerns this particular concession. The Nicaragua Canal Association, which was formed in 1886, sent out early in 1887 to obtain a concession to build this canal. Nicaragua had the right to give this concession, and in it gave us the fullest freedom to locate the route, but for the reason that the treaty of 1858 gives to Costa Rica the right of navigation and that in the construction of the canal waters would be made to overflow Costa Rican territory, Costa Rica took the ground that Nicaragua should have recognized that treaty to the extent at least of obtaining the consent of Costa Rica to this concession. Nicaragua did not do that. We accepted the concession in good faith, believing Nicaragua had the absolute right to grant it. The first thing we encountered was a protest, thirty or forty days thereafter, from Costa Rica, announcing that the concession was of no value because she had not been consulted. The Government of Nicarauga could have consulted her before, and have gone on and satisfied her for any damages which the overflow might do to her territory, but we were left to make terms with Costa Rica. We then for six months negotiated to obtain a concession from Costa Rica, when this was accomplished. Nicaragua immediately protested against our concession from Costa Rica. We assured Nicaragua that we had accepted the concession from Costa Rica simply in the nature of a quitclaim of any rights she might have; and when we formed our company and accepted the Costa Rica concession we accepted it only in so far as it did not conflict with the territorial rights and proprietary interests of the Republic of Nicaragua. Thus we were entirely open and frank in the whole transaction.

Now you will readily see that up to that point it was useless to talk about the sale of bonds with the protest of either government pending Then when the first expedition, sent out after the Maritime Company was organized, commenced work on the 3d of June, 1889, Nicaragua officially notified us that, while she would protest against our concession from Costa Rica, yet she would not go beyond protesting and would not interfere with the construction of the canal. But in July Nicaragua ordered the stopping of our work at Greytown. We did not pay attention to that order, because she immediately modified it by saying that she would not regard the work as an official commencement of permanent work. The troubles continued and were fostered by parties from England, whose names I know, who wanted to have the 24th day of October arrive and the Government of Nicaragua not recognize that we had begun our work, so that our concession would lapse. On the 16th of September, 1889, the Government of Nicaragua notified us officially that if we did not confine ourselves within her limits, thereby ignoring any rights or claims of Costa Rica, she would not approve our surveys nor recognize the commencement of the work of construction, and that on the 24th of October she should consider our concession as having lapsed.

This course of Nicaragua was so unjust, that I went immediately to the Government here, through the State Department. I stated the case fully. Mr. Blaine met the question with great fairness and promptness, and immediately wired to the American minister at Central America to go to Nicaragua and say to the Nicaraguan Government that he was surprised at the report of the attitude of the Nicaraguan Government towards this company, and wished him to examine into the facts and report to the State Department here, and at the same time to assure the Government of Nicaragua that the Government of the United States would not remain passive and see the rights of its citizens threatened. That dispatch of Mr. Blaine had the desired effect. Mr. Mizner and

Mr. Hall, our permanent agent there, arranged a plan by which Nicaragua could recede from her position with dignity, which was in the form of a joint declaration. On our part we agreed to go on and build the canal in good faith under the concession, and the Nicaraguan Government agreed to approve the surveys and work, so that the work of construction was recognized officially as commenced on the 8th of last October. I will submit copies of the telegrams between the President of Nicaragua and myself.

[Copy of telegram sent October 9, 1889.]

His excellency PRESIDENT OF NICARAGUA,
Managua:

Please accept my sincere congratulations upon the happy termination of all differences, and the company's assurance that it will vigorously prosecute the work of the canal in the interest of Nicaragua and the whole commercial world.

HIRAM HITCHCOCK,
President Maritime Canal Company of Nicaragua.

[Translation of telegram received from the President of Nicaragua in reply to ours of October 9.]

MANAGUA, *October* 11, 1889.

President of the Maritime Canal Company of Nicaragua:

I congratulate myself jointly with you upon the happy settlement of the canal question, and with the greatest satisfaction I offer the cordial assistance of my Government to the efforts of the company for the realization of this grand enterprise.

ROBERTO SACASA,
President of the Republic.

Q. So that all this work was begun before?—A. Surveys were begun in November, 1887, and $250,000 had been spent on the work prior to June, 1889, and everything had been entirely harmonious except in the matter of protests, as stated, down to the point when this attempt was made through various influences to cause the Government to dispossess us of our concessionary rights.

Now you can readily see that with protests from Costa Rica at the very start, with protests from Nicaragua, with all these troubles, this company was not in a position to say one word about the sale of stock or bonds until the 8th of last October. Very soon after that we were confronted with one of the tightest money markets New York and the financial world has seen of late, which has only in the last sixty days been relaxed, so there are strong reasons why we have never attempted to place the securities of the company.

We have had a great many questions asked about our securities, and we have always been willing to listen to them.

Q. You mean questions asked you by people who represent capital?—A. Yes; people come—we do not always know how much capital they represent—and say "We can place your bonds, so and so." Our reply has been, "We can not offer our bonds under present circumstances." Of course the time is soon coming when we can take up the subject. The Government of Nicaragua is very friendly now, and most thoroughly in earnest and ready to help us in reference to this canal all in its power. But by October next we are pledged to put into that work $2,000,000. Now we shall get that $2,000,000 into the work. Senator Miller, president of the Construction Company, assures me that there is no question about it; so that there will be no reason for the Nicaraguan Government raising any objection that we have not complied with all the terms of the concession; but of course it will depend somewhat upon plots and schemes, and upon the eyes of her engineers. They may see five or six millions and may not see one. Between Nicaragua and Costa Rica there is always danger of difficulty coming up in reference to this canal and the question of their respective rights there. I had a telegram the other day that the Costa Rican Government had appointed another commission to confer with Nicaragua again as to that. Nicaragua at this stage of the proceedings might simply propose to pay for the 400,000 or 500,000 or 600,000 acres of land (which may be overflowed by our dams) of Costa Rican territory, and arrange as to navigation, etc., then there could be no further claim upon Nicaragua or upon us. But until the respective rights of those two powers are settled there will always be more or less difficulty.

There is another point I would like to mention. I have always felt entirely secure as to the position of this company as chartered by Congress, not only because it was chartered by Congress, but on account of the treaty of 1867 between the United States and Nicaragua. The terms of the treaty are particularly strong and conclusive. The United States has the same right over the Nicaragua route under the treaty of 1867 as it has over the Panama route. If there is any difficulty that obstructs our transit through that territory the United States has the right to go in and preserve order just as she has done on the Panama route under the treaty with Colombia. So that I have felt entirely confident that in the end the company, if it went on in good faith, which it surely will, will receive the protection of the United States, not only because it was incorporated by the United States, but because of these treaty relations, and because of the importance of that route to the United States.

Q. Now give us the synopsis of your permanent contract.—A. As I said before, these amounts can not be correctly defined until these various questions are settled. (Mr. Hitchcock here read the synopsis, and the committee directed that it be not printed but placed on the files of the committee.)

By Senator EDMUNDS:

Q. What is the actual top-working estimate of the engineers on their final revision; what amount of actual cash, it being ready in hand, will that canal cost?—A. I will state that as definitely as I am able. Our own engineer, Mr. Menocal, makes a full and final estimate, as in his judgment absolutely sufficient to build the canal, $65,000,000. The advisory board of engineers, which we called in to review those plans, and whom we told "we have not called you to approve these plans, but we call upon you to find all the fault you possibly can; that is your business, and we want you particularly to review these figures"—they carried that estimate up from $65,000,000 to $80,000,000. They also added $7,000,000 for the following reason: They said, "You have a peculiar country there. It is a volcanic country. It is not actively so now, but it has been in years past, and when you build these dams you do not know how many crevices, as the water rises, it may find to go through; and therefore you do not know how many leaks you will have to stop; and, while we do not really believe it will cost you that, it may possibly files of the committee directed that it be not printed but placed on the cost you a few million dollars; so we will add $7,000,000 for that item." That carried it up to $87,000,000.

Q. They allowed a certain amount for contingencies in the ordinary way, and then, as a special contingent fund in view of unforeseen possibilities, they added $7,000,000?—A. Yes. So that the actual construction of the canal, according to the advisory board, would cost $87,000,000. Then of course there would be some expenses of administration. I have always said that the lowest amount that should be fixed as the probable actual economic cost of that canal would be $100,000,000. I have never had any other opinion.

Q. Who were the gentlemen who composed the advisory board of engineers?—A. The advisory board was, first, Mr. John Bogart, as chairman, who was the chief engineer of the Erie Canal system. The others were Mr. Wellington, who is an expert engineer and has had a great deal to do in advising about the construction of large aqueduct and other works in this country; Mr. Myers, who is a very prominent railway engineer, and who lives, I believe, at Richmond, and has constructed a great many railway lines; Mr. Charles T. Harvey, who was the constructing engineer of the Saulte Ste. Marie Canal, and Prof. H. A. Hitchcock, the professor of civil engineering in the Thayer school of engineering at Dartmouth College. That was the advisory board.

Q. Would it be possible for your company, in making this permanent contract, to insert in it a clause that if the United States should at any time before the completion of the work, wish to take the things off the hands of the Construction Company, advance money itself, and thus save the enormous difference between actual cost and outstanding obligations and stock, that then the contract should terminate right where it was and be settled up, and its further execution, so far as getting such a great amount of bonds in excess of the actual cash to be used, should stop? By that I do not mean that the Construction Company should stop doing the work and being paid for it in cash, or any adjustment that should be made, but whether you could manage with them to have the door left open for the United States to step in and help you all out in some suitable way, so as to save this enormous amount of outstanding obligations at the end.—A. I have no doubt but what such an arrangement could be made, and I will say very frankly that I think I represent a dominant interest—a dominant body of men in this canal, who, while they expect to realize something from it, yet their desire is so strong for the canal that there will be no personal consideration in the way of the arrangement that you suggest, and I should very decidedly favor it. They are not a selfish body of men. You take men like Frederick Billings, Judge Daly, Mr. Fairbanks, Mr. Darling, and all those gentlemen, and first of all they want the canal built.

Q. I hope, Mr. Hitchcock, and I have no doubt that both my colleagues and doubtless the whole committee will agree with me in that hope earnestly, that your company which Congress has chartered, if you are compelled to make definite and final arrangements before any judgment of Congress, in view of the present situation, can be taken definitely one way or the other, that you will have a clause inserted which shall enable you, justly and legally to the Construction Company, to stop this enormous waste of obligations in such a way that the United States may come to your assistance.—A. I should favor that very decidedly.

By Senator PAYNE:

Q. Is it a part of your obligation under your charter to report annually?—A. Yes; and I have submitted already a copy of our annual report.

By Senator EDUMUNDS:

Q. Have you any copies of the concession of Nicaragua and Costa Rica?—A. I have brought over for you everything I thought you might possibly want. The concessions are out of print, but I have brought over a copy of each of them; also a report of the consulting engineers and a report of the final location by Chief Engineer Menocal.

[The copies of the concessions, etc., were placed on file.]

Committee adjourned.

SENATE OF THE UNITED STATES,
COMMITTEE ON FOREIGN RELATIONS,
Saturday, June 28, 1890.

The committee met at 10.30 a. m. Present, Senators Sherman (chairman), Edmunds, Frye, Evarts, Dolph, and Payne.

There were also present, at the request of the committee, Hiram Hitchcock, president of the Maritime Canal Company of Nicaraugua, and Warner Miller, president, and Alexander T. Mason, attorney of the Nicaragua Canal Construction Company.

STATEMENT OF HIRAM HITCHCOCK—Continued.

By the CHAIRMAN:

Q. Mr. Hitchcock, it is presumed you know the situation of the matter before us. We want to get from you the precise financial status of the Maritime Canal Company and also of the Construction Company, and we would like to have you make your statement in your own way. We want to know the precise amount of the obligations you are under either for improvements made or for expenses already incurred, including obligations now existing or that are accruing, so as to get at the exact present condition of the two companies. We have your former statement here before us, and you need not go over that unless it is necessary to repeat some portion of it.—A. Allow me to say that in my previous statement I answered such questions as were asked, and made some further remarks with reference to this matter. I did not go into all of the details of the transactions relating to the concessions, as I took it for granted that you gentlemen were fully conversant with nearly all those particulars. In order to answer your question clearly, I will go back to the Nicaragua Canal Association which obtained the two concessions from the Governments of Nicaragua and Costa Rica, respectively. Under those concessions the Canal Association was obliged to form a construction company and also to take measures for the formation of the Maritime Canal Company of Nicaragua. It immediately formed the Construction Company, which was incorporated three years ago this month.

Q. That is the Construction Company?—A. The present Construction Company, to which company the concessions were transferred by the association. Under the terms of the Nicaragua concession the Nicaraguan Government is to receive 6 per cent. of the stock, as we believe, of the company, but as they believe 6 per cent. of all the securities issued by the company. That question remains unsettled, a construction of the clause referring to that matter not having been agreed upon. The Costa Rican concession calls for a million and a half, or 1½ per cent. of the stock of the Maritime Company. The Maritime Company has not as yet issued any of its stock to those Governments. The association itself, under the terms of the concession from Nicaragua, is entitled to the same compensation which the Government of Nicaragua receives; that is, 6 per cent. of the securities of the Maritime Company.

Q. Repeat that sentence.—A. I say that under the concession the association itself, that is, the Nicaragua Canal Association——

Q. The old association?—A. The old association under the fifty-first article was to receive from the Maritime Company 6 per cent. of the stock and bonds of the company to be formed.

By Senator **Edmunds**:

Q. The fifty-first article, do you say?—A. The fifty-first article. Now, those two concessions, as I stated, were disposed of to the Construction Company in order that the work might go on, and we were obliged under the concessions to form a construction company, and we had to wait a long time before we could form, as we believed properly, the Maritime Company. We waited for this Congressional charter and organized under it. Now the Maritime Company was formed——.

Q. The old association was merged in the Maritime Company?—A. The old association was dissolved; the Maritime Company was formed and purchased of the Construction Company all its right, title, and interest in and to the two concessions—for which it agreed to pay $12,000,000 stock of the Maritime Company. The stock has not been issued; and the stock has not been issued to those two Governments. We have not issued the $12,000,000 to the Construction Company, although we have agreed so to do. We left it to be delivered at their demand, and the obligation still remains to deliver on call to the president of the Construction Company this $12,000,000 Maritime Company stock that is agreed to be paid for these concessions.

By the **Chairman**:

Q. One-half of which goes to the Nicaraguan Government and the other half to the Construction Company?—A. No, that is entirely different. Six per cent. is to go to Nicaragua, and 1½ per cent. to Costa Rica, but the Maritime Company pays to the Construction Company for those two concessions, with all the rights, privileges, and franchises thereunder, $12,000,000 stock.

Q. Does that $12,000,000 cover the amount that goes to Nicaragua and Costa Rica?—A. No, sir; that is entirely independent.

Q. Then you are under obligations to issue $12,000,000 to the Construction Company, $6,000,000 to Nicaragua, and $1,500,000 to Costa Rica?—A. Yes.

Q. Nineteen million five hundred thousand dollars?—A. Yes.

Q. Now, what are you to receive for that?—A. That was regarded a the just value of the concessions which the Construction Company ha purchased of the association. That of course includes the $6,000,00 stock which the association is entitled to under the terms of the co cession, and any right they might have to 6 per cent. of bonds and per cent. of any future increase of capital stock. So the Constructio Company, for taking hold of this enterprise and practically carrying on, receive an additional $6,000,000 of stock; but you gentlemen wi remember that the Costa Rican concession was subsequent to that from Nicaragua, and has of course very great value. Without it the canal could not be built as at present located.

Q. Then, if I understand you, the answer to my question is, that you are under obligations to issue in the aggregate $12,000,000 stock to the Construction Company, $6,000,000 to Nicaragua, and $1,500,000 to Costa Rica?—A. Yes.

By Senator EDMUNDS:

Q. There would be no additional claim by the construction company?—A. No, sir. Whatever the association was entitled to receive under the 51st article of the concession, which was 6 per cent. of the stocks and bonds, was conveyed by it to the construction company, and subsequently by the construction company to the Maritime Canal Company of Nicaragua.

Q. But you have not issued that stock yet?—A. No, sir.

Q. Who compose the association that got this concession of Mr. Menocal?—A. The association was originally formed of Frederick Billings, Chief Justice Daly, Admiral Ammen, Commander Taylor, Horace L. Hotchkiss, Francis A. Stout, Commander Crowninshield, Engineer Menocal, and myself. That was the original meeting, but the number was afterwards increased and included perhaps one hundred and twenty-five, possibly one hundred and fifty gentlemen.

Q. Did that association have a corporate existence?—A. No, sir; it was simply a business association for the purpose of obtaining concessions.

Q. Did it keep books, minutes of its meetings, etc.?—A. It kept minutes of its meetings.

Q. Where are they, are they in your possession?—A. They are not in my possession. The association some time ago went out of existence.

Q. That association turned itself into the Construction Company?—A. No, sir; it held its organization intact. Its members aided in forming the Construction Company.

Q. When was the Construction Company formed?—A. It was formed nearly three years ago this month.

Q. Before the passage of the act to incorporate the Maritime Canal Company?—A. Yes. The Construction Company commenced work in December, 1887.

Q. Who composed the Construction Company?—A. It was composed mainly of the gentlemen of the association.

Q. Give the names of everybody you can remember.—A. There was Mr. Billings, Governor Fairbanks, of Vermont, who was succeeded by his brother, Col. Franklin Fairbanks, Judge Daly, Mr. Stout, Mr. Hotchkiss, Mr. Thompson, of the First National Bank of New York, Mr. Darling, Mr. James Roosevelt, Mr. Robert Garrett and T. Harrison Garrett, of Baltimore, Robert A. Lancaster, of Richmond, Joseph Bryan, of Richmond, Mr. Cohen, of Savannah, Mr. Aldige, of New Orleans, Mr. Anderson, of Cincinnati, and I presume I could think of a good many more of them.

By the CHAIRMAN:

Q. Which one of the Andersons?—A. I think, William P. Anderson.

By Senator EDMUNDS:

Q. When was this transfer from the original association to the Construction Company made? I understood you to say that the concessions were first transferred to the Construction Company by the association.—A. Yes.

Q. Now, when was that?—A. It was in September, 1887.

Q. Was that in writing?—A. That is my impression, yes.

Q. Have you got the books here which show the entries and engagements, etc., on which the transfer from Menocal and his associates to the Construction Company was made?—A. Not to my knowledge.

Q. Are you a member of the Construction Company?—A. I am a member of the Construction Company, yes.

Q. You are not an officer?—A. No, sir. I left New Hampshire yesterday morning and do not know what papers have been brought here. As I said, all the books and papers of the association are in the custody of the late secretary.

Q. Yes, the books and papers of the Maritime Company and the Construction Company are in the possession of the officers of the company?—A. Yes, sir.

Q. You being president of one company and Mr. Miller of the other?—A. Yes.

Q. Mr. Miller, have you the books and papers showing the transfer of Mr. Menocal's rights?

Hon. WARNER MILLER. We have the papers all here.

Q. Are you willing to produce them so that we can see exactly what the transaction was?—A. Mr. Mason will produce all the papers.

Q. I suppose the papers will show exactly what this transfer was?—A. Yes.

Q. That, you say, Mr. Hitckcock, was in 1887?

Mr. HITCHCOCK. September, 1887.

Q. Now, when was the first engagement made between the Maritime Company and the Construction Company?—A. The first engagement between the Maritime and Construction Company was made very near, in fact, immediately after the organization of the Maritime Company, which was in May of last year, 1889.

Q. Were those engagements in writing, by contract, or by correspondence?—A. They were in writing by correspondence.

Q. Are all the undertakings between the two companies in writing?—A. Yes.

Q. There are no private contracts or correspondence, then, that do not appear in your books and papers?—A. Not at all.

Q. I suppose the Construction Company has its separate books; these entries will appear in two sets of books?—A. Yes.

Q. What was the nature of the engagement you made with the Construction Company?—A. The same that I mentioned the other day.

Q. Was there any other engagement between the two companies except what you stated the other day?—A. As I stated to the committee then, the two companies had practically made an agreement, but it was not signed and it could not be signed for the reason I gave; and that is, we could not tell how many bonds to put into that contract, and the matter had been held under advisement for that reason.

Q. Where is the engagement to which you referred, in answer to Mr. Sherman, as an obligation on the part of the Maritime Company to issue nineteen millions of stock. We can see as far as the concessions go how much goes to the Governments of Nicaragua and Costa Rica, but in respect of what you say you give the Construction Company of your stock?—A. That was a purchase by the Maritime Company from the Construction Company of the two concessions which the Construction Company then owned under its purchase from the association.

Q. Yes, it was a purchase of a paper transaction?—A. Yes.

Q. Did it precede or follow this temporary working contract that you showed us the other day?—A. It was the same day, if I remember right.

Q. Did you say anything about that to us the other day when you were here?—A. No, sir; not at all.

Q. Did you say it was in writing?—A. Yes, sir; it was in writing.

Q. And was put in writing at that time, I suppose?—A. Yes. That was a purchase by the Maritime Company from the Construction Company.

Q. Does that appear by the books of your corporation?—A. It does.

Q. And I suppose in the books of the Construction Company?—A. Yes.

Q. Well, it is rather unfortunate that so important an item was left out the other day.—A. It is unfortunate. It did not occur to me, and I was not asked a question about it. It was a purchase of those concessions by the Maritime Company of the Construction Company.

Q. Yes, but it was purchased, as you say, in round numbers, for $12,000,000?—A. Yes.

Q. And you had engaged to pay it in stock?—A. Yes, sir.

Q. And I asked you how much stock you had out and you said 10,145 shares?—A. Yes.

Q. And here was an obligation of the company you did not disclose, amounting to an engagement to deliver $12,000,000 stock paid up to the construction company?—A. That is true, but the stock had not been issued, and I was asked how much was issued, and confined myself to that question. I had no desire to conceal anything.

Q. You were coming on here so rapidly to-day I suppose you were not able to bring the books of your company?

Mr. ALEX T. MASON. I brought them with me, and have them here (producing them).

Q. Then let us see the entries as to the purchase of these concessions. This book you now produce is the récord of the meetings of the executive committee of the Maritime Canal Company?—A. Yes, sir.

Q. That is the company chartered by Congress?—A. Yes, sir.

Q. Now this begins on the 24th of May. That is the same date you refer to. Now come to that part of it. I will just read this. It shows a meeting on the 24th of May. Present, Messrs. Hitchcock, Mason, Hotchkiss, and Daly, of the executive committee. In the absence of Mr. Billings, Mr. Hitchcock was appointed chairman.

> The Secretary then read a communication received from the Nicaragua Canal Construction Company offering to assign to the Maritime Canal Company of Nicaragua for valuable considerations the concessions of the Governments of Nicaragua and Costa Rica, which were assigned to said Construction Company by the Nicaragua Canal Association. Mr. A. C. Cheney and Mr. H. C. Taylor attended the meeting of the committee to present the views of the Construction Company as to the consideration which should be paid by the Maritime Canal Company for the proposed assignment of the concessions. After some discussion the representatives of the Construction Company withdrew for consultation, and subsequently presented the proposition of their company as finally agreed upon and embodied in the following resolution:
>
> *Resolved*, That the President be and he hereby is authorized and directed to notify the Maritime Canal Company of Nicaragua that this company will transfer and assign to the said Maritime Canal Company the two contracts or concessions granted by the Republics of Nicaragua and Costa Rica, respectively, together with all the rights, powers, privileges, property, benefits, advantages, and franchises of every nature and kind whatsoever which this company as assignee of the Nicaragua Canal Association has in, to, by or under said concessions, and also all the data in its pos-

session relating to surveys, explorations, reconnaissances, and estimates, which are now in its possession, for the sum of 12,000,000 dollars in full paid up shares of the capital stock of the Maritime Canal Company of Nicaragua.

On motion of Mr. Daly, seconded by Mr. Hitchcock, the following resolutions were unanimously adopted:

Resolved, That the proposition of the Nicaragua Canal Construction Company for the transfer and assignment of the Nicaragua and Costa Rica concessions to this company be and the same is hereby accepted upon the terms and conditions therein set forth: *Provided, however,* That it is understood and agreed that the concession granted by the Republic of Costa Rica is accepted by this company upon the condition that nothing therein contained shall be construed to affect the sovereignty or proprietary interests of the Republic of Nicaragua so far as the same may have been established by the treaty of April 15, 1858, between the Governments of Nicaragua and Costa Rica; *And be it further*

Resolved, That the president and secretary are hereby authorized to execute, under the corporate seal of this company, such agreements as may be necessary to complete the transfer and assignment of said concession upon the terms and conditions aforesaid, and also to deliver over to said the Nicaragua Canal Construction Company, upon receiving the proper deeds of transfer, ($12,000,000) twelve millions dollars in full paid shares of the capital stock of this company.

That goes to the temporary contract or offer to do the work of which we had copies before. Now, Mr. Hitchcock, did you execute the deeds that were mentioned to be executed—papers of transfer?

Mr. HITCHCOCK. Yes.

Q. As separate documents?—A. Yes.

Q. This being merely a minute of the meeting, of what was proposed and what was accepted?—A. Yes.

Q. Now then, where are those documents?—A. They are here.

Q. Just let us see the one by which you have engaged to pay. I want to see when you are to issue the stock absolutely. Were you to issue this stock when they delivered the deed containing the concessions?—A. Yes, the agreement so states, but in view of the questions with reference to issuing stock, as I said before, the understanding was that the stock should not be issued to the company except on the demand of the president of the Construction Company.

Q. Was that understanding in writing?—A. No, sir; it was a verbal understanding.

Q. But they actually delivered to you the deed transferring the concessions?—A. Yes.

Q. And left you under an obligation not performed?—A. Yes.

Q. On the face of it, you have delivered the stock then and there, I suppose; that is what the resolution says?—A. That might be the construction, I suppose; they have never asked for it.

Q. You were one of the association, you say; how much did the association pay for these same concessions?—A. I can not give you the exact figures.

Q. Well, in round numbers?—A. Several hundred thousand dollars.

Q. Well, one, two, or three?—A. I should think, for both concessions, something like half a million dollars, including all the expenses connected with them.

Q. What is the character of those expenses, name them?—A. They were cash advances. For instance there was $100,000 advanced to the Government of Nicaragua.

Q. That was the deposit required?—A. Yes.

Q. Well that is $100,000?—A. Various expenses of organization, some expenses of preliminary surveys and things of that sort.

Q. Then you transferred them, as you said before, to the Canal Construction Company?—A. To the Construction Company, yes.

Q. How much did they pay you for those concessions?

By the **Chairman**.

Q. Let me ask before you answer that—this Construction Company was formed before the Maritime Company, was it?—A. Yes, two years before.

Q. Is that the same Construction Company that is now in existence?—A. The same now in existence.

By Senator **Edmunds**:

Q. Under a Colorado charter?—A. Yes. I can not tell you all the Construction Company paid, but it paid more than the association paid.

Q. In what form did it pay it?—A. They paid it in stock, I think.

Q. Stock in the Construction Company?—A. In the Construction Company; yes sir.

Q. Did they pay any cash?

Mr. **Mason**. There was no cash payment.

Q. When did that transaction take place?—A. I think in August, 1887.

Q. Immediately after the Colorado charter?

Mr. **Hitchcock**. The Colorado charter was in June, and this was August following.

Q. Well, the Construction Company books, I suppose, show just how much was paid?—A. Yes, sir.

Q. And what in?—A. And what in.

Q. You understand it to be something more; were you one of the sellers?—A. Yes, and the payment was in stock. Certain advances were made, but the payment was in stock.

Q. How much stock?—A. Eleven million nine hundred and ninety-eight thousand dollars. It was paid by the issue of the Construction Company stock.

Q. Issued to the owners of the concession?—A. Yes.

Q. Being the gentlemen who you have named and others of the same sort that you have not named?—A. Yes, sir. What I meant by money advances is that the Construction Company had made advances from time to time. When it was finally settled——

Q. I think you stated before that the Construction Company was composed of substantially the same gentlemen?—A. Yes.

Q. The Maritime Company, as far as the people composing it are concerned, is substantially the same company?—A. Yes.

Q. And the concessions having been obtained for half a million dollars the holders turned them over to the company formed under the Colorado charter for an issue to them of $11,998,000 in stock; how was that precise sum computed? It is an odd sum, being so near to $12,000,000?

Mr. **Mason**. It was computed in this way: The capitalization of the Construction Company was $12,000,000, of which enough was subscribed for to effect the organization of the corporation, and the balance was issued in payment of this charge.

Q. So that what was issued in the form of a corporation and what was turned over for these concessions made the charter amount of the capital?—A. Yes.

Mr. **Miller**. I would like to have Mr. Mason, who has been the attorney all the way through, make a concise and plain statement from beginning to end so that it will appear just what the transactions were.

Senator **Edmunds**. Yes. I wanted to be sure that at this time I had not forgotten anything Mr. Hitchcock had said, so as not to send for him again. I understand this transaction makes the association the owner of the whole stock of the Construction Company, being the same persons.

Mr. HITCHCOCK. I join with Senator Miller in the request he makes.

By the CHAIRMAN:

Q. And the $12,000,000 issued by the Maritime Company to the Construction Company is practically the same amount, is it not?

Mr. HITCHCOCK. Yes.

Q. The stock of the Maritime Company was issued to the holders of the concessions?—A. The holders of the concessions are entitled to six millions or 6 per cent.

By Senator EDMUNDS:

Q. They sold out all that for $12,000,000 in round numbers. The Construction Company, therefore, have stock of the Maritime Canal Company, chartered by Congress, for $12,000,000, you all, in substance, being the same body of gentlemen?—A. Practically the parties owning the concessions form these two companies.

Senator EVARTS. It never became, as I understand, a matter of transaction and substance until it came to the issue of a certain number of shares in the Maritime Company; is not that so?

Senator EDMUNDS. Yes.

The CHAIRMAN. The Maritime Company paid $12,000,000 of their stock for concessions and expenses incurred before that time.

Senator EDMUNDS. Agreed to pay it, and the Construction Company paid $12,000,000 stock in round numbers to the gentlemen who formed the association, and all the same parties all the way through. Is there anything else, Mr. Hitchcock of any kind as to the obligations of the Maritime Canal Company in respect to these concessions and the work that you have not stated on the other occasion and now?

Mr. HITCHCOCK. No, sir; I do not recall any now.

Q. Then this, in round numbers, now represents the whole and every kind of engagement and liability that the Maritime Canal Company is under?—A. Yes.

Q. And you have described all sort of liabilities?—A. Yes, and I want simply to assure you that there was no intent of reserving anything on my part the other day, but the question did not happen to come up in that form and this was a purchase and sale between the two companies.

STATEMENT OF ALEXANDER T. MASON.

The Nicaragua Canal Association was formally organized on the 3d of December, 1886, by Messrs. Daly, Stout, Hotchkiss, Taylor, Billings, Crowninshield, Hitchcock, Miller, and Menocal, for the purpose of securing from the Government of Nicaragua a concession or grant with all the rights and privileges required for the construction and operation of a ship canal within the limits of that country connecting the Caribbean Sea with the Pacific Ocean, together with all works accessory to or beneficial in the construction or operation of said canal. Articles of agreement were signed by the various members, and Mr. Francis A. Stout was elected president, and Mr. J. W. Miller, secretary. Negotiations were conducted in Nicaragua on behalf of the Nicaragua Canal Association by Mr. A. G. Menocal, and resulted in his obtaining the canal concession now in force. This concession was duly ratified by the Nicaraguan Congress, and was subsequently, on the 24th of April, 1887, approved by the president of the Republic, and on the same day accepted by Mr. Menocal on behalf of the association. The objects for which the association was formed having been virtually accomplished when the concession was obtained, it became necessary for the purpose of complying with the terms and conditions therein contained, and in order to carry on the work of completing the final axial surveys for the location of the canal, to organize a new corporation. Accordingly, on the 10th day of June, 1887, the Nicaragua Canal Construction Company was duly incorporated under the general laws of the State of Colorado with a capital fixed at $12,000,000.

By the CHAIRMAN:

Q. Can you leave with us a copy of that document (referring to a printed copy of the certificate of incorporation of the Nicaragua Canal Construction Company)?—A. Yes; but I think you have one already in your possession.

On the 12th day of August, 1887, the Nicaragua Canal Association sold, assigned, transferred, and delivered to the Nicaragua Canal Construction Company, in consideration of the sum of $11,998,000, in the capital stock of the said construction company, all the rights, powers, privileges, property, benefits, advantages, and franchises of every nature and kind whatsoever which the said association had in, to, by or under the said concession granted by the Republic of Nicaragua, excepting, however, the right to organize the Maritime Canal Company of Nicaragua and the right of representation in the first board of directors thereof. This assignment and transfer included and covered the 6 per cent. of shares, bonds, certificates, and other securities of the said Maritime Canal Company of Nicaragua, to which the association was entitled under the fifty-first article of the concession.

By Senator FRYE:

Q. One moment, please. Did that transfer include the Costa Rican concession as well as that from Nicaragua?—A. No, sir; for at that time the concession from Costa Rica had not been obtained.

After the above transfer had been completed, and the consideration therefor duly paid, the Nicaragua Canal Association turned back into the treasury of the Construction Company six millions of the stock which it had received as a gift for the purpose of enabling the Construction Company to raise, by the sale thereof, the funds that were needed to carry on the preliminary work under the concession, and to complete the final surveys and the location of the canal.

By Senator PAYNE:

Q. This was a donation?—A. It was a voluntary donation on the part of the association, and the proceeds of this stock, which has been sold by the Construction Company from time to time, have been devoted to carrying on the work connected with the enterprise.

At the time the sale and transfer above referred to was made, none of the members of the association were members of the Construction Company, but of course they became stockholders in the new corporation as soon as the stock delivered in payment for the concession was distributed. The Construction Company having become the owner of the Nicaraguan concession at once commenced operations on the line of the canal and undertook the work required to be done under article 47 of the concession within the period therein named. Up to this time the association had supposed that the concession granted by the Republic of Nicaragua conveyed an absolute title to the entire route of the canal, but no sooner had the engineering expedition, sent out by the Construction Company, landed at Greytown than the Republic of Costa Rica filed its protest against the construction of a canal over the proposed route without its consent. This protest alleged that, under the treaty of limits of April, 1858, entered into between the respective Governments of Nicaragua and Costa Rica, the latter Republic was the owner of certain rights in and to the port of Greytown and the river San Juan of which it could not be divested by the Republic of Nicaragua without its consent. The questions arising as to the proper construction to be given to the said treaty were referred by both Governments to President Cleveland as arbitrator, and his award, which was rendered on the 22d day of March, 1888, virtually decided in favor of Costa Rica. It then became necessary for the association, in order to remove all difficulties which had arisen or might thereafter arise in regard to damage or injury which might be caused to the natural rights of Costa Rica in the construction of the canal, to obtain from that Republic a contract of some kind. Negotiations were accordingly started, and resulted in what is known as the Zeledon-Menocal Concession, which was duly ratified and approved by the President of Costa Rica on the 9th day of August, 1888.

By Senator EDMUNDS:

Q. That being the concession we have a print of and which is dated July 31, 1888?—A. Yes, sir; it was approved August 9, 1888.

Q. Yes; that was the final approval by the President.—A. Yes; this concession, as I have already stated, was obtained by the Nicaragua Canal Association in order to perfect its original title to the route of the canal. As the Nicaraguan concession had already been transferred to the Construction Company, the Nicaragua Canal Association, on the 24th day of May, 1889, also transferred the Costa Rican concession to the said Construction Company for the good and valuable consideration already received by it under the contract of August 12, 1887, and for *an additional* cash consideration to cover the expenses actually incurred *by the association* in obtaining the new concession. The Construction

Company thus became the absolute owner of both concessions, subject to the terms and conditions therein contained. This was the condition of affairs at the time the Maritime Canal Company of Nicaragua was duly organized under the charter granted by the United States Government.

On the 24th day of May, 1889, the Nicaragua Canal Construction Company assigned, transferred, and delivered to the Maritime Canal Company of Nicaragua the said two concessions granted by the Republics of Nicaragua and Costa Rica, respectively, together with all and singular the rights, powers, privileges, property, benefits, advantages, and franchises of every nature and kind whatsoever which the said Construction Company as assignee of the Nicaragua Canal Association had in, to, by, or under the said concessions. This transfer was made in consideration of the sum of $12,000,000 in full paid-up shares of the capital stock of the Maritime Canal Company of Nicaragua of the par value of $100 each. The Construction Company, prior to this time, had completed the final surveys, and was ready to commence in Nicaragua the preliminary work of installation. Owing to the existence of certain difficulties between the Republic of Nicaragua and the company, which had been caused by the granting of the Costa Rican concession, it was deemed of vital importance that work on the canal should be commenced at the earliest possible date, so as to satisfy the Nicaraguan Government of absolute good faith on the part of the company. It was decided, therefore, that work should be commenced at Greytown, if possible, during the first week of June, 1889, and, as the time was too short within which to prepare and execute a permanent contract between the two companies, the preliminary contract which Mr. Hitchcock has already submitted to you on a former occasion, was entered into on May 24, 1889. On the strength of this contract the Construction Company organized an expedition which was immediately dispatched to San Juan del Norte.

By Senator PAYNE:

Q. That was in June?—A. Yes, sir; the expedition commenced work on June 3.

By Senator MORGAN:

Q. Sailed from here on that date?—A. No, sir; arrived down there on June 3. Immediately after the expedition had sailed the board of directors of both companies met and appointed a joint committee, consisting of three members from each board, to consider the question of a permanent contract between the two companies and to report to the respective boards such a proposed document as they might be able to agree upon. This joint committee met two or three times a week for three or four months until a contract was unanimously agreed upon. It was reported by the committee to both boards and was adopted and approved by both companies, and their respective officers were duly authorized to execute the same.

By Senator EDMUNDS:

Q. Can you turn to the entries of that ratification and the votes of the boards of directors on that point?—A. Yes, sir [examining book]. Shall I read it?

Q. If you please; and give the date.—A. The date is January 2, 1890.

Q. Which company's books are you reading from?—A. The minutes of the board of directors of the Maritime Canal Company of Nicaragua.

Q. Now read it.—A. (Reading:) "At the request of the Chairman of the joint committee upon the contract Mr. Mason presented the draft of a contract which had been agreed upon in committee and directed to be presented to the respective companies as the committee's report. The contract submitted was read to the board and ordered on file. Mr. Fairbanks moved that the report of the committee be accepted and the contract, as read, be approved, and that the president and secretary of the company be and hereby are authorized and directed to properly execute the same when the Construction Company shall be prepared to do the same on its own behalf. The motion was seconded by Admiral Ammen and on vote unanimously adopted."

Q. Now turn to the Construction Company and give us their vote?

By Senator PAYNE:

Q. Was that in January?—A. January 2, 1890. [Reading from book containing the minutes of the board of directors of the Nicaragua Canal Construction Company.] "*Resolved*, That the contract between the Maritime Canal Company of Nicaragua and the Nicaragua Canal Construction Company as presented and read to the board, be and the same is hereby approved and that the officers of this company are hereby authorized and directed to execute the same and affix the seal of the company thereto." The resolution was passed unanimously.

By Senator EDMUNDS:

Q. That is the 3d of January, 1890.—A. The day after the action taken by the Maritime Canal Company of Nicaragua.

By the CHAIRMAN:

Q. Is not that contract embodied in the minutes?—A. No, sir; it was filed with the secretary of each company.

Q. Have the contracts ever been recorded anywhere or simply placed on your files?—A. Each company has a copy on file.

By Senator EDMUNDS:

Q. At the meeting on the 2nd of January of the Maritime Canal Company I read here [reading from record book]: "Present, Messrs. Hitchcock, Daly, Hotchkiss, Mason, Ammen, Stout, Darling, and Fairbanks." That was the meeting, was it not?—A. Yes, sir.

Q. Now at the meeting on the same day of the Construction Company were present Messrs. A. C. Cheney (in the chair), J. L. Macauley, R. Sturgis, H. R. Hoyt, J. W. Miller, and A. F. Hedges. They were the directors of the Construction Company, and these other gentlemen were the directors of the Maritime Canal Company?—A. Yes, sir. The board of directors of the Construction Company met on the 2d to receive the report of the committee, but did not take definite action on the same until the meeting on January 3, 1890.

By Senator DOLPH.

Q. Have both of these companies by-laws?—A. Yes, sir.

Q. Are they there before you?—A. They are in the minutes.

Q. Will you refer to the provision in the by-laws of each company with regard to meetings, showing when the regular meetings are and how special meetings are called?

By Senator EDMUNDS:

Q. Which contract is referred to in those two votes?—A. The permanent contract. As I stated, the joint committee which drew it was appointed shortly after the preliminary contract was signed.

Q. And that permanent contract is the same one, then, of which Mr.

Hitchcock the other day gave us a synopsis?—A. I presume that it is the same one.

By Senator FRYE:

Q. Are they at work under the preliminary contract now?

Mr. MASON. The final contract is practically in effect. It has virtually been agreed upon by both boards.

By the CHAIRMAN:

Q. Has it been written out and signed?—A. It has never been signed by the officers, but the minutes of the Maritime Canal Company show that the officers of that company were authorized and directed to execute it as soon as the construction company was prepared to do the same. The Construction Company has not executed it up to the present time.

By Senator DOLPH:

Q. Now, Mr. Mason, will you read the conditions of your by-laws about meetings?—A. Yes, sir. Article 5 of the by-laws of the Maritime Canal Company of Nicaragua provides:

> Regular meetings of the board of directors shall be held on the first Thursday of each month. Special meetings of the directors may be called at any time by the president, or, in his absence, by the vice-president, by causing a notice of the same to be sent by mail or telegraph to each director at least one day in advance of such meeting, and a special meeting of the board shall be called by the president at any time, upon the written request of three directors.

Q. Is there anything providing that a quorum shall be necessary or what shall constitute a quorum?—A. Yes, sir. The same article provides that at any meeting of the board of directors the presence of a majority of the members of the board shall constitute a quorum——

Q. At all meetings?—A. Yes, sir.

Q. Now read the provisions of the other company. Which company is that?—A. I have just read from the by-laws of the Maritime Company.

Q. Now state the same as to the Construction Company.—A. Article 6 of the by-laws reads as follows:

> ARTICLE VI. Regular meetings of the board of directors shall be held on the third Thursday of each month.
>
> Special meetings of the directors may be called at any time by the president, or in his absence by the vice-president, by causing a notice of the same to be sent by mail or telegraph to each director at least one day in advance of said meeting, and a special meeting of the board shall be called by the president at any time upon the written request of three directors.
>
> The meetings of the board of directors shall be held at the principal office of the company in the City of New York, or at such other place as the board of directors may from time to time direct.
>
> Any meeting of the board of directors at which a quorum is not present may be adjourned from time to time by those present as they may direct, and such adjournment shall be deemed to continue in session the meeting so adjourned.
>
> The presence of a majority of the members of the board of directors shall constitute a quorum.

Q. Was either of the meetings at which this contract was agreed to a regular meeting?—A. I think so. I know the Maritime Canal Company's was.

Q. That was a regular meeting?—A. Yes, sir.

Q. And the other must have been a special meeting?—A. Yes, sir.

Q. Was there a majority of the directors present at both meetings?—A. Yes, sir.

Q. Was notice given as the by-laws require of a special meeting of the Construction Company?—A. Yes, sir.

Q. Is there any record there or statement of that.

The CHAIRMAN. I suppose it gives the names of the persons present?

Mr. MASON. It gives the names of the persons present.

By Senator DOLPH:

Q. The entry does not show that due service was given?—A. No, sir, it simply says at a regular meeting. We are not called upon really, under the by-laws, to give notice of a regular meeting.

Q. Do you know why the Construction Company has not executed this contract?—A. I do not know whether they have finally fixed upon——

Q. Are there any blanks left in the contract as to the amount of compensation or stock?—A. Not as reported by the committee, no sir.

Q. Nor as agreed to by the company.—A. Nor as agreed to by the company.

By Senator EDMUNDS:

Q. Well, as I understand from these minutes the draught was presented to these boards of directors?—A. Yes, sir.

Q. Now, did that draught, which the directors at the meeting directed their president to execute, contain any imperfection or blank or other thing to be filled or determined upon?—A. There may have been something in regard to the denomination of the bonds or the rate of interest. There were seven draughts made of the contract before the final report was submitted, and I should have to refer to the final draught.

Q. Have you got the final draught here?—A. Yes, sir. My recollection is that the amounts were all filled in. I have my draught of it.

Q. Is that the final draught?—A. Yes, sir, the final draught.

Q. It was drawn up in duplicate I suppose?—A. Yes, sir.

Q. And you have one of the duplicates?—A. Yes; that is to say, this draught I have here is the original draught from which the two copies which are on file with the two companies were made and is identical.

Q. Is this the paper which was submitted to the board of directors?—A. This is an exact copy of the paper.

Q. Yes, but is that made from the paper submitted to the board or is the paper you have here—— A. The two papers which the boards approved were really made from this, this being the draught copy.

Q. I merely wanted to get at the precedence of the order. This, then, is the draught from which the duplicate contracts, ready to be signed, as you understand at any rate, then presented were made?—A. Yes, sir.

Q. So that this paper now in your hands is identical with those duplicates?—A. Yes, sir.

Q. Now, see if there is any blank there?—A. (Examining paper.) Here is a blank in the date——

By Senator PAYNE:

Q. Those papers were prepared by you, I suppose?—A. Yes, sir. It is the work of the committee, but I acted as the attorney. (Continuing examination of paper.) I do not see any blanks in this copy.

By the CHAIRMAN:

Q. Is that signed by any one at all?—A. This is not signed; no, sir.

By Senator **Edmunds**:

Q. Had you finished making your consecutive statement?—A. I think I have given you all the facts up to the time of the contract.

By the **Chairman**:

Q. If there is anything else, now, that bears upon your liabilities or your present condition we would like to have it up to this time. Since that time, under the provisional contract, as I understand, the Construction Company has gone on and done a good deal of work?—A. The Construction Company has been engaged at work since June last. It is practically operating under the permanent contract.

By Senator **Evarts**:

Q. That is a very important point. You had agreed by resolutions to a definite contract to be executed by your officers. Now if that rests in abeyance unexecuted, either in form or in substance, it is one thing; but as you now stand, upon that condition of obligations between the companies, your company has allowed the transaction to go on as under the permanent contract, which is different from what it would be if it had been going on merely under the provisional contracts; which is it?—A. Well, I shall have to refer that question to the presidents of the two companies.

By the **Chairman**:

Q. Is there any difference in the mode or manner of work or mode of payment between the provisional contract and the permanent contract?—A. Yes; the permanent contract provides for payment in stock and bonds.

By Senator **Edmunds**:

Q. I see here, Mr. Mason, in the fourth head of this contract, which is exactly like the papers laid before the two boards, "that it"—that is the Construction Company—"that it will begin work on this contract on the Nicaragua Canal within thirty days next after the execution of this agreement, and will complete the construction of said canal with its appurtenances and other works and deliver the same to the party of the second part ready for operation on or before October, 1897;" and then goes for other things?—A. Yes, sir.

Q. Now then, if, as you say, this work is now going on under this unsigned duplicate contract that you have described, when does the period of the obligation of the company to begin within thirty days and to end it by 1897 begin to operate?—A. I can only answer that by saying that I understood at the time, and have understood ever since, that when the contract is executed it will be executed *nunc pro tunc*, as of the date it was approved.

Q. But the language is "after the execution of this agreement," which, I take it, means the sign manual of the persons authorized to sign. A. Well, I suppose, strictly speaking, that is so; but the board of directors were unanimous in regard to this contract, and although the act of signing it was delayed for one reason or another, it was virtually understood that when it was executed it would be executed *nunc pro tunc* as of the date it was authorized.

Q. You say it was delayed for one reason or another. Can you give any reason?—A. Personally I know of none.

Q. You are a member of the board?—A. I am a member of the board of directors of the Maritime Canal Company.

Q. Have you any relations with the Construction Company?—A. The firm of which I am a member are the attorneys.

Q. Yes, but you are not an officer of it?—A. No, sir; I am not an officer.

Q. You are not a director?—A. I am not in the board of directors.

By Senator PAYNE:

Q. I would like to ask one question about that $6,000,000 stocks of the association that is retained by them as their personal property; they donated $6,000,000 to the Construction Company, and it remains with them?—A. Yes; it was distributed to the shareholders of the association. The association has since been dissolved.

Q. How much of the $6,000,000 stock donated have they disposed of?—A. I shall have to refer you to Senator Miller.

By Senator EVARTS:

Q. Have any transfers taken place of the $6,000,000 retained by the original association?—A. Whether there have been any transfers of that stock I do not know, but I presume there have. It was originally transferred to the shareholders of the association, but whether they have parted with any portion of it I can not say. The transfer books will show that.

By Senator EDMUNDS:

Q. Are you willing we should have a copy of this paper [the contract] for our use and examination?

Mr. MILLER. We would not like to have it published, but have no objection to leaving it with the committee.

Mr. HITCHCOCK. Mr. Chairman, I would like to say in this connection what I said before, that while the officers of the company are authorized to sign this contract, yet they and the committees of the two companies decided that it was a contract which it might be desirable to submit to the counsel of bankers who propose to take hold of these bonds to see if any change is necessary. In the next place, the questions of duration of the bonds and the fixing of a rate of interest has to be considered, and until those matters are settled it is impossible to fix definitely the sum of bonds and stock to be put into this contract to pay for that work, and that is the reason why the officers have held back from signing this contract, and while, as I stated, it was a contract practically agreed upon, it is an unsigned contract.

By Senator FRYE:

Q. Then the present operations are going on under this contract?—A. I understand that they are.

Mr. MILLER. I understand they are. Since I became president—of course this all took place before I came in—the outgoing president told me this, and the conditions we were in, and that we were proceeding under the imperfect contract; but by a mutual understanding, which had no record or anything, the actual signing of the contract had been left in abeyance, thinking something might come up in the negotiation of bonds, thinking something might have to be changed and it could be changed better before it was actually signed than it could otherwise; but we were proceeding under the contract as there drawn up.

Senator EVARTS. That would come to this, that if the contract was executed what had been done between the two companies would be treated as if it were executed.

Senator **FRYE**. That is, if $1 was expended $2 would be expected.

Senator **DOLPH**. As I understand you, Mr. Hitchcock, the consideration to be paid by the Canal Company, which is, in fact, the conditions on your part, is still left open and undertermined; that is, the amount of stock and bonds to be paid under this contract is still undetermined?

Mr. **MILLER**. Not left open so far as our company is concerned at all, unless we see fit to re-open it.

Mr. **HITCHCOCK**. What I mean is this, that the Maritime Company must realize sufficient from its stock and bonds to build this canal, and until it can see a little clearer what it is going to get for its stock and bonds, we can not tell how much to put into this contract.

Q. Under that contract what would the Maritime Company have to do with the stock and bonds? If the construction work is to be so much stock and so much bonds, the contract being executed, that would be their lookout?—A. Yes, perfectly true. They have consulted our committee, and we have to be consulted as to the duration of the bonds, and they have asked us to consider the market with them.

Q. So that, to come back to my question, the amount, as you understand it, of stock and bonds, that is the consideration to be paid by your company, is still an open matter?—A. It is a matter which we may see fit to reopen.

Q. Do I understand you to say that the amount, as well as the interest and duration, is open?—A. In the way that I have stated. Until we can see more clearly than we can now about what is to be realized for stock and bonds we can not tell how much to pay.

Q. In other words, the Construction Company is not willing to take a specified amount of the stock and bonds of your company for the work, but that is to be left open until they ascertain what the stock and bonds are to be sold for, so that they can get sufficient consideration?—A. That question can be better answered by the Construction Company.

Q. I merely asked what you thought.

The **CHAIRMAN**. This is absolutely certain, that Congress will probably not intervene and subscribe for this stock until the amount of the stock and the cost of the improvements are fixed, and probably until modifications are made by the consent of these two contracting parties.

Mr. **DOLPH**. I can not see how.

Mr. **MILLER**. The considerations are all set out in that contract. We have gone on directly under that contract since I have been president.

By Senator **EDMUNDS**:

Q. When did you begin to be president?—A. I came in in February.

Q. That was a month after the meeting of the two boards of directors?—A. About that. There is nothing now that prevents my signing that document to-morrow and calling upon the Maritime Company to sign it.

Q. But I understand you to say now that that contract, to which we refer, is a positive obligation and you are executing it on the part of your company?—A. I am; yes, sir.

Q. Well, if it is a positive obligation why is not that obligation just as difficult to deal with as if it was signed?—A. It is. As I said, it ought to have been signed. I found it in that condition and so I went on with it.

Q. Then, if we correctly understand you now, speaking as the president of the Construction Company, the contract of which we have been speaking is in force and is in process of execution?—A. Yes, sir.

Q. Just as it reads?—A. Just as it reads; that is my understanding.

Q. Then I think it right to say right here to Mr. Hitchcock and you, only speaking for myself alone, that the situation is totally different from what I understood it to be when we had the pleasure of hearing your statements two or three weeks ago, and if your contract is binding there is nothing, as a member of Congress, I wish to do on the subject. It is totally out of any disposition of mine to undertake to go into a scheme that is already committed for $150,000,000 bonds and $70,000,000 stock, but, as I say, I only speak for myself.

The CHAIRMAN. To that I will subscribe. So far as any aid is to be rendered by Congress is concerned, the difficulty with me is the $19,500,000 outstanding. As a matter of course, what Costa Rica and Nicaragua are to get is right under the concessions, but it seems to me, as to your $12,000,000, there will have to be a re-adjustment of that matter.

By Senator EDMUNDS (to Mr. Miller): Let me see if I understand in point of fact as to actual outgoes, leaving out of view for the moment the labor, time, and trouble, and the value of influence and all that, but in actual money. I understand, from Mr. Hitchcock's statement, and perhaps from yours also the other day, and now again from Mr. Hitchcock, that somewhat towards half a million dollars were spent by the gentlemen composing the original association in one way and another to get the concessions. Now, then, since the concessions have been turned over to the Colorado association no cash was paid, but $12,000,000 in stock. Now, then, the Construction Company, being organized, has proceeded to issue stock of its own and raised money upon it. How much money has it raised?

Mr. MILLER. Well, it has issued no stock except the original——.

Q. Yes, how much money has the Construction Company raised?—A. It issued $4,000,000 stock at 50 cents on the dollar, and is now issuing the balance of it. It is not all issued yet and not all paid in, but it will have received for its stock about $3,500,000 turned back into the treasury, and that money is put into the construction of the canal expecting to be recompensed by the Maritime Company by the issue of its stock.

Q. Well that constitutes, then, the whole receipts for this stock of the company which it has issued at 50 cents?

Mr. DOLPH. And about $800,000 paid over from the Maritime Company besides?

Mr. MILLER. Yes, that has been paid for work that has been done.

By Senator EDMUNDS:

Q. That was paid for work, but under the permanent contract or how? You say the permanent contract is in force. That did not call for the payment of any cash?—A. That was paid before I had anything to do with it.

Q. Then the total amount of money your company has had up to now has been about $2,000,000?—A. Just at the present time. Of course there are obligations.

Q. Well, you subscribed for a million dollars stock of the Maritime *Company; did you* pay that in cash?—A. Yes.

Q. Where did you get the cash, on the issue of your own stock?—A. Yes.

Q. So that that is a part of the $2,000,000. So that the actual outgo all around down to this time, saying nothing about outstanding obligations, for execution of work is in round numbers $500,000 for obtaining concessions, etc., by the association and $2,000,000 besides?—A. That is about it. This other money is coming which——

Q. Yes, and other expenses of construction, I suppose, from day to day. Is that the substance of the statement?—A. Yes.

Q. How much stock of the Construction Company is now actually outstanding in round numbers; you do not know exactly?—A. Well, about $10,500,000, I should think, in round numbers.

Q. And on that there has been paid up 20 per cent., making $2,000,000——

Senator FRYE. No, but that includes the $6,000,000 in the Maritime Company.

By Senator EDMUNDS:

Q. About the whole of the capital stock of the Construction Company is outstanding; how much is the balance unpaid?—A. About $1,000,000, perhaps a little more.

By Senator DOLPH:

Q. That is a part of the $6,000,000 returned?—A. Yes.

By Senator EDMUNDS:

Q. Yes, but it comes out of the whole $12,000,000 of your capital stock, if I am right. Now, then, how much of this outstanding stock of your company which is in the hands of stockholders or anybody else is subject to assessment?—A. It is not subject to assessment at all except as it is sold. When it was sold, the stock sold at fifty cents on the dollar, was paid in installments.

Q. Yes, but a man having paid $50 would get a full paid share?—A. Yes.

Q. So that none of the stock is subject to further assessment?—A. No.

Mr. MILLER. In reference to Judge Edmunds's statement that he thought my statement varied from that of the other day, I have not gone over it carefully, but I do not think so. I stated in regard to the contract that the permanent contract had been completed as substantially made, that there were only some minor points left open. By left open I meant there was a general understanding between the two companies that if it became necessary to change it we could change it; that is, it was not one of those contracts that if Congress stepped in and wanted to do something we could not change the contract and make it satisfactory, or if a set of bankers came in and said we want this or that rate of interest, the change could not be made. That was my meaning at the time, but I stated distinctly that the main contract was substantially made as I understood it. So far as the Construction Company was concerned, if the Government wanted to come in and take stock or guaranty the bonds, I had not any doubt that satisfactory arrangements could be made that this contract could be changed by the consent of the two boards.

Senator EDMUNDS. The only remark I intended to make was that the situation as it now appears to me is entirely different from what I understood it.

Adjourned.

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